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FLAME CULTIVATION

By

Harold T. Barr

TECHNOLOGY AND SCIENCE ROOM

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FLAME CULTIVATION

By
HAROLD T. BARR

The use of flame for killing or controlling weeds and grasses in the crop row has received much attention in the past few years. The scarcity of labor during the war, the increasing price of labor, and the uncertainty of having sufficient labor when needed, have caused farmers to take hold of many machines and methods that will produce crops with less labor and cash outlay. For the past few years considerable effort has been put forth in developing mechanical side hoes, mechanical blockers, chemical sprayers and the use of flame, all in the hopes of producing crops with fewer man hours and at a more economical price.

The principle of using flame is to project a hot blast of gases upon the small weeds and grasses in and around the base of the growing plant. The flaming should be performed while the grasses and weeds are small for best results. The length of the exposure required to control or kill weeds varies greatly, depending upon the weed, age of the plant, weather, growing conditions, etc.

Johnson grass growing in sugarcane can be controlled to a fair degree by starting on the grass as soon as it is 2 to 5 inches tall. However, if the Johnson grass is 12 to 18 inches tall and the sugarcane of about the same size or slightly taller, then a severe burning to control the grass will retard and damage the sugarcane. In some cases where severe burnings were used, the sugarcane yields were lowered so much that it would have been better to have used no control, other than conventional cultivation.

In one series of tests on nine cuts with a corresponding number of check cuts the average sugarcane yield was one ton per acre higher on the flamed plots as compared to that on the hand-hoed check plots. The number of stalks per 100 feet of row, brix, sucrose, and purity were almost exactly the same when comparing flamed against hand-hoed. In this series of tests the burners were set to hit the ground at the base of the sugarcane and the rate of travel was maintained very close to two miles per hour. In other tests in which the set of the burners was not watched and the rate of travel was irregular, the yield was lowered two to three tons of sugarcane per acre.

The following are some types of grasses that can be successfully controlled: sheep foot, wild parsley, indigo, crab grass, tievines, cocklebur, nut grass, and water grass. Intensive application of heat is not advisable, since frequent scorching is a more effective method of control. Be sure burners are set the proper distance from the plant row, that the correct uniform speed is maintained, and the flame strikes the ground at the base of the plant. In order to get a good economical kill of grass and weeds the flame should be 12 to 15 inches long with an average temparture of between 1,800 and 2,000°F. With the above temperatures, a speed of two miles per hour has proved satisfactory under average conditions. The number of flamings in sugarcane will depend entirely on the season and the amount of weed and grass infestation; normally three or four applications will be required.

Cotton should be 6 to 8 inches or more in height, or about 3/16 inch in diameter at the ground at the time of the first flaming. With 6-inch cotton the burners must be mounted and so controlled as to keep the hot gases from direct contact with the leaves or they will be scorched and killed. Some growers are using a mechanical device for covering small cotton of 2 to 6 inches in height, and burning out the cotton in the drill between the covered plants. The cylindrical covers should be at least 14 inches in their long dimension so as to allow for some variation in rows and driving of the tractor. The distance between hills may be varied by changing the number of cylindrical covers and size of wheel. A typical unit for this purpose is shown in Figure 1. The flame method of chopping cotton is best performed by setting the burners directly opposite each other and allowing one burner to strike at the ground line and the other about 2 inches above the ground. The above burner setting will be sure to kill all the leaves and the plant and not allow it to struggle on as a half-sick or stunted plant.

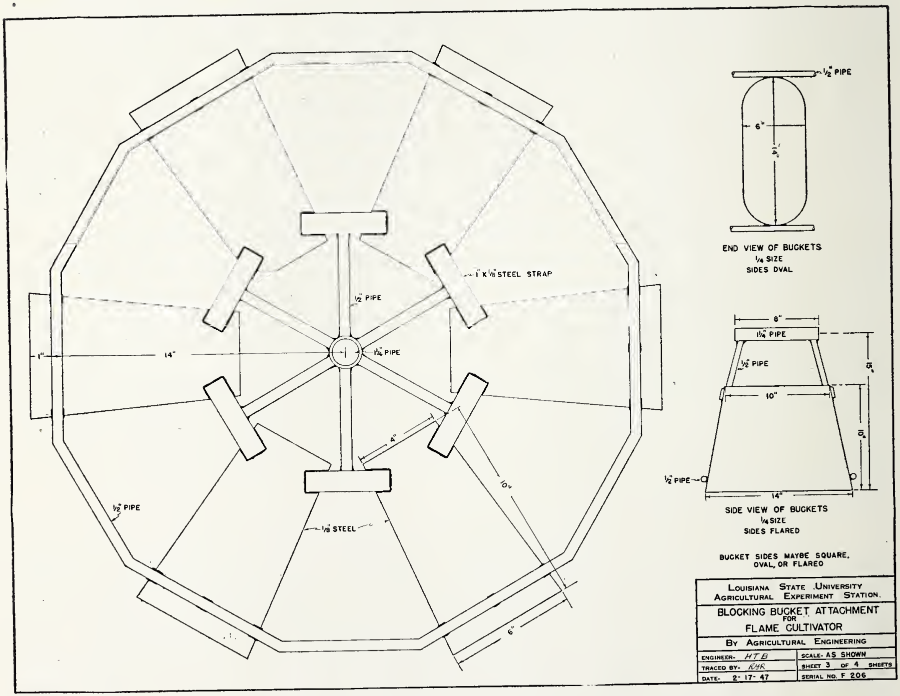


FIGURE 1. — Blocking bucket attachment such as used in thinning cotton by flame.

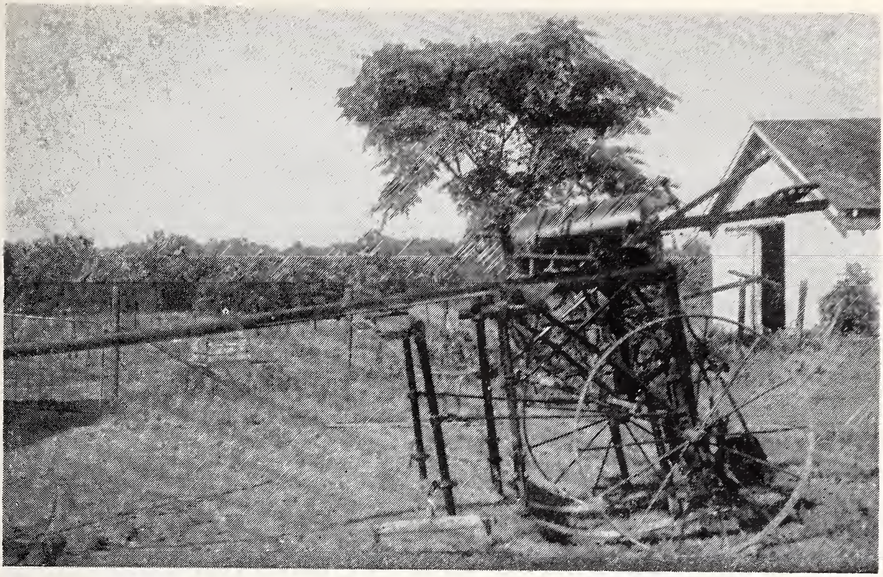


Figure 2. — One-row flame cultivator built from an old cultivator. It burns kerosene or tractor fuel.

Two-year tests and observations in Louisiana, Mississippi, and Alabama indicate that flaming to control weeds and grass in cotton has a definite place in the mechanization of the crop. Flaming enables more acres to be handled per man and a cheaper cost of production per pound. With the mechanical harvester, the elimination of all grasses by flaming at later dates than normal hoeing, will result in a much better sample of cotton.

Devices or implements for flaming crops are many and varied in design. In 1900 patents were granted on an "insect-destroyer" which consisted of four burners, two on either side of the row, together with proper fuel tank and pipes for mounting on a one-row cultivator. A little later another patent was granted on a "burner or torch whereby extraneous growths may be burned from plants of various kinds, or from the ground around the roots of plants, or in places which are otherwise inaccessible to ordinary weed and growth destroying implements, such as hoes, cultivators, and the like, and has for one of its objects to provide a simply constructed device which may be carried from place to place, and in which some form of hydrocarbon liquid, such as crude kerosene oil, or the like, is employed as a fuel, and which may be readily adjusted to direct the flame of the torch or burner in any required direction." In 1943 a patent was granted on a "Method of Cultivation of Plants" by flame and in 1945 another patent on a "Machine for Flame Cultivation of Plants," and still later in 1945 another patent was granted on an "Apparatus for Flame Cultivation of Plants." Other patents were issued during 1946 on "Flame Cultivating of Plants" and "Weed Burners."

Because of necessity many farmers have built their own flame cultivators in the past few years in order to get such a unit. Previous to 1945, only one fabricator (as far as is known) was offering a machine especially built for row crop flaming, and this in a limited area and limited number.

A typical simple one-row unit built from an old cultivator is shown in Figure 2. In this unit a 20-gallon fuel tank with built-in hand pump

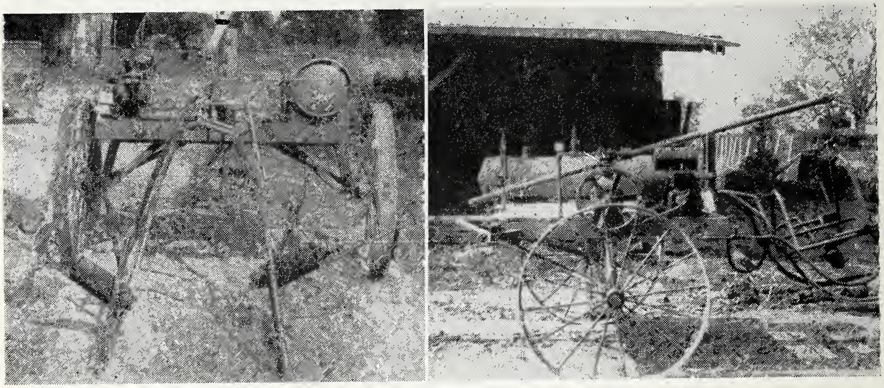


Figure 3. — Rear view (left) and side view of a plantation-built, one-row flame cultivator that burns either kerosene or tractor fuel.

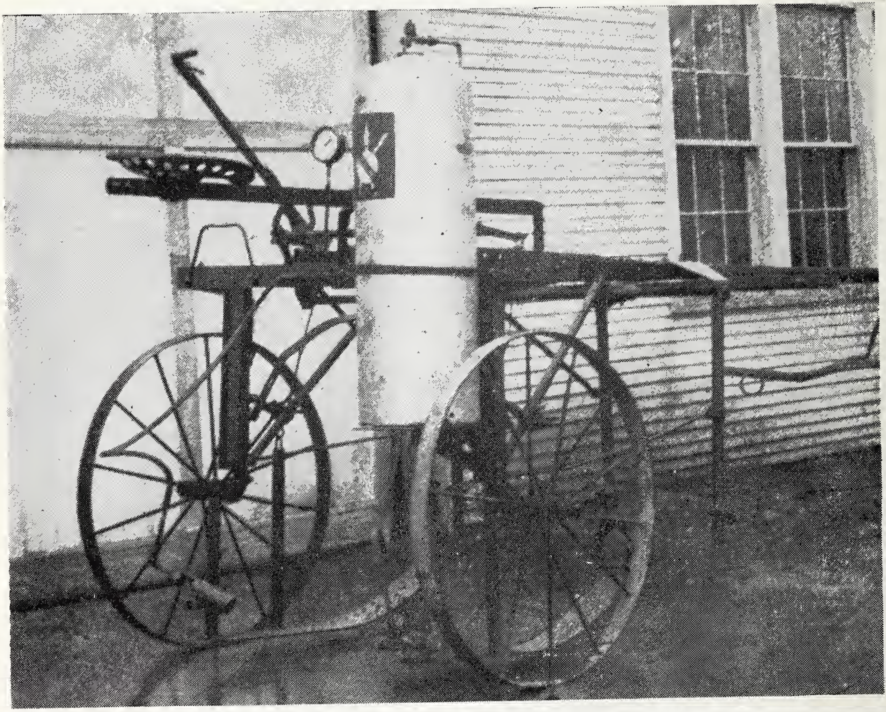


Figure 4. — One-row butane or propane flame cultivator.

for maintaining 25 to 40 pounds pressure is mounted on top of the implement and connected by pressure hose to two generating burners. The burners are carried on skids on either side of the row. This implement was used with light tractor fuel with success in sugarcane during the 1943 crop.

An adaptation of this same idea is shown in Figure 3. This machine was built on a plantation that has its own machine shop and welder. In this machine the fuel is put in an old galvanized water tank and pressure is maintained by a 2-cubic-foot compressor driven by a one-horsepower air-cooled engine. This unit uses the generating type burners with kersosene or light tractor fuel. The machines shown in Figures 2 and 3 will burn approximately one gallon of fuel per burner per hour.

In Figure 4 is shown the simplest form of flame cultivator. This consists of a 20-gallon tank of compressed propane gas, a reduction valve, a pressure gauge, a few pieces of pipe, a flexible pressure hose, two burners, and skids. The flame unit is mounted on an old cultivator. Where compressed petroleum gases, propane or butane, are available, they can be used and will eliminate the need for a compressor and engine or power take-off.

In Figure 5 is shown a two-row flame cultivator attachment that can be mounted on any standard cultivating tractor. The unit is self-contained and is easily attached by placing two clamps over the rear axle, two brace rods to the drawbar, and connecting to the hydraulic system on the tractor. In case it is desirable to remove the drawbar, the braces may be attached to the bottom of the axle housing, or truss braces may be run from the top of the tank to convenient locations on either side of the engine.

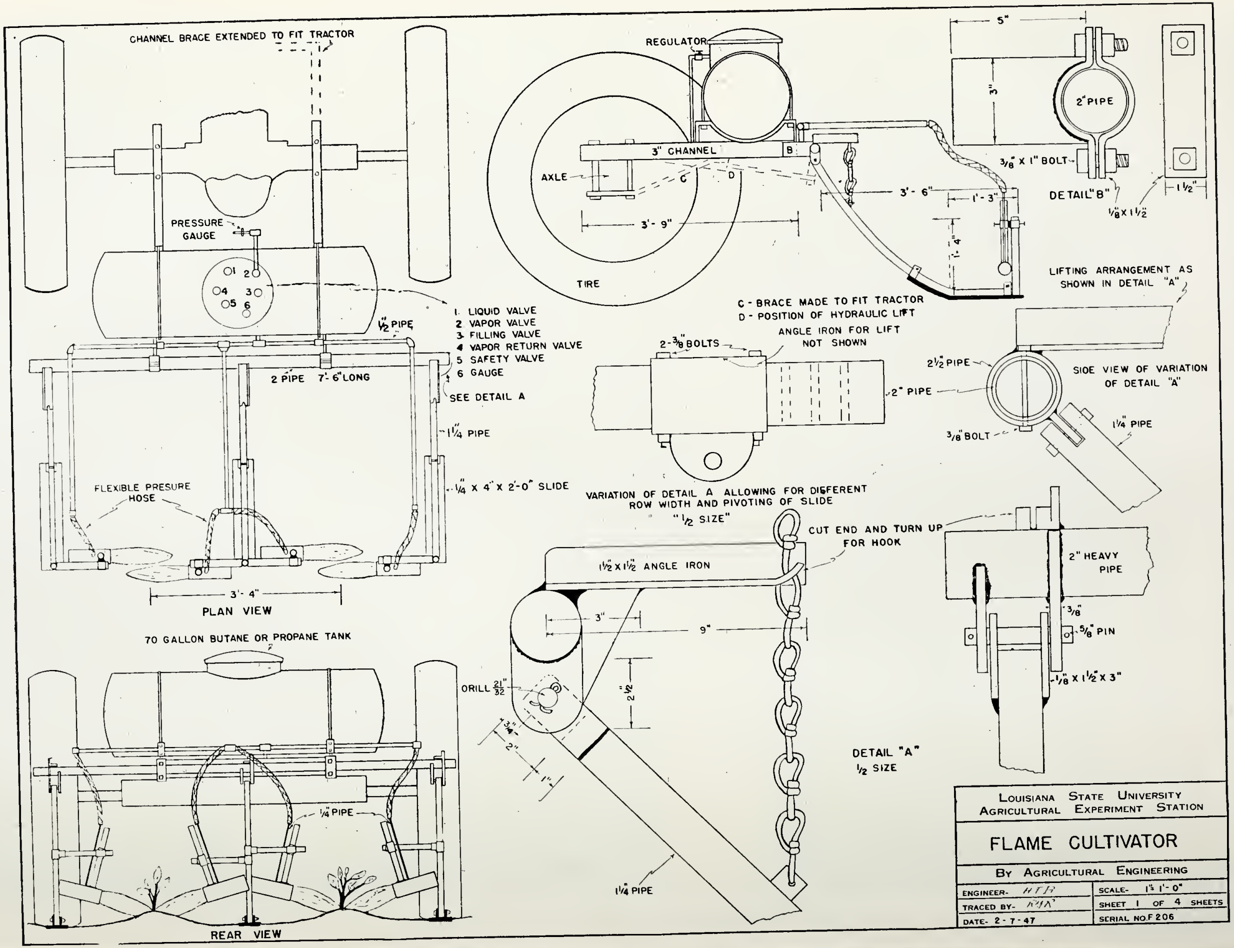
The flame cultivator consists essentially of a channel iron frame, a 70-gallon (butane or propane) tank, a 2-inch extra heavy pipe drawbar, three 1-1/4-inch pipes with slides and the necessary burners, pipe, flexible hose, regulator, and pressure gauge.

A 70- or 80-gallon tank will be found satisfactory for a two-row machine but a larger tank would be preferred for a four-row machine in order to prevent filling in the middle of the day.

The flame cultivator can be built for a fixed row spacing or can be so constructed as to allow for different row widths, as shown in Figure 5, detail "*A*".

The flame cultivator as shown in Figure 5 is equipped with self-vaporizing burner as shown in Figure 7, and requires only a constant pressure valve in the liquid line near the tank for controlling and shutting off the fuel. A pressure gauge, range 50 pounds, is desirable on the low pressure side of the constant pressure valve, to assist the operator in getting a quick setting of the burners.

Some have offered considerable opposition to the use of compressed petroleum gases, claiming dangerousness and lack of sufficient heat and



5. [illegible] tractor-mounted butane or propane flame cultivator.

drive in the flame. With proper safeguards the dangerousness can be overcome and by choosing the proper burners all the drive and heat needed can be obtained. Several commercial burners tested were not adaptable to this use and failed to give the type flame required. The burner shown in Figure 6 gave a good kill on young grass at 10 to 15 pounds pressure, burning butane or propane. If this is your first experience with a flame cultivator, start off at 15 pounds vapor pressure on the burner. If this amount of flame is not killing the grass at the speed you are using, then increase the pressure gradually, raising it until a satisfactory weed and grass kill is secured without damage to the crop. Pressures of 40 to 50 pounds are being used successfully in some instances with the tractor speed being varied according to density and age of the grass. This burner is made from a piece of 2-inch black iron pipe 10 inches long, with a 2-inch section cut away on each side near one end as shown in Figure 6, as a vent for air entrance. The gas is fed into this vented end by a 1/4-inch pipe in the center of the 2-inch pipe.

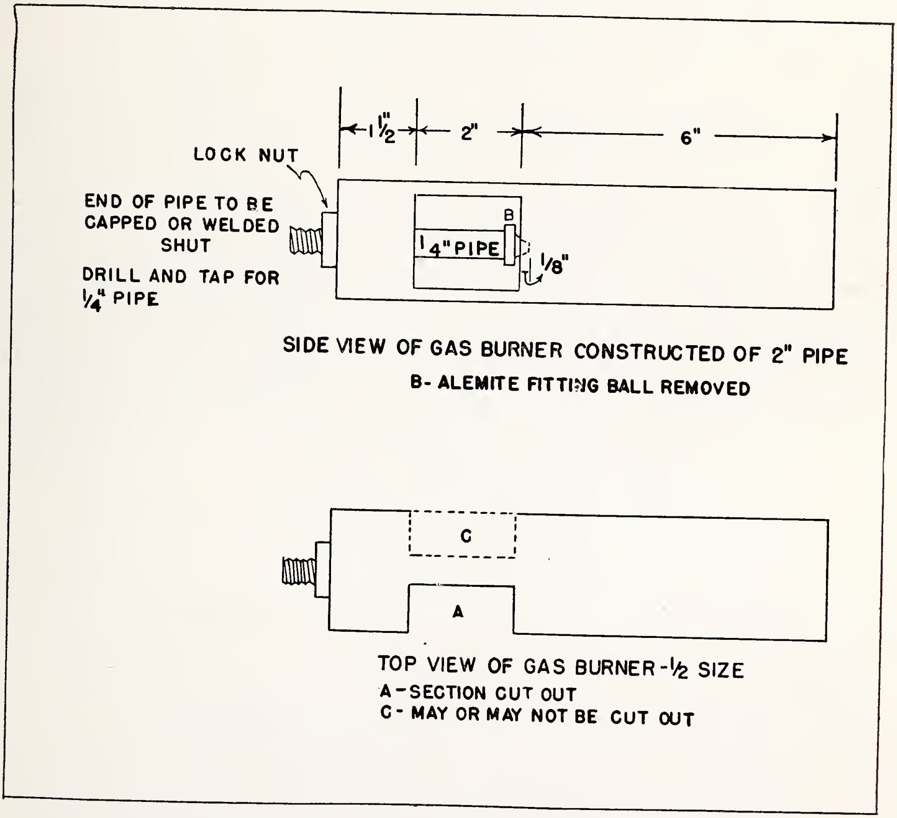

1½"
2"
6"
LOCK NUT
END OF PIPE TO BE CAPPED OR WELDED SHUT
DRILL AND TAP FOR ¼" PIPE
B
¼" PIPE
⅛"
SIDE VIEW OF GAS BURNER CONSTRUCTED OF 2" PIPE
B- ALEMITE FITTING BALL REMOVED
C
A
TOP VIEW OF GAS BURNER-½ SIZE
A-SECTION CUT OUT
C- MAY OR MAY NOT BE CUT OUT

Figure 6. — Louisiana State University burner.

For best results, set end of alemite fitting about 1/8 inch inside of the 6-inch section of burner. Tests with this burner with different size openings in the tip gave the following results:

Size of Opening in Burner Tip	*Vapor Pressure on Burner*	*Gallons Per Hour*
1/16" = .064"	10 lbs.	1.49
	15 lbs.	1.70
No. 55 wire drill = .052"	10 lbs.	1.04
	15 lbs.	1.14

Use the lowest pressure and smallest size tip that will give a satisfactory weed kill at the rate of travel normally used.

The burner shown in Figure 6 is convertible to a liquified petroleum gas burner for butane or propane by adding a vaporizing chamber as shown in Figures 7 and 8. In Figure 7 a piece of 3-inch pipe is welded in

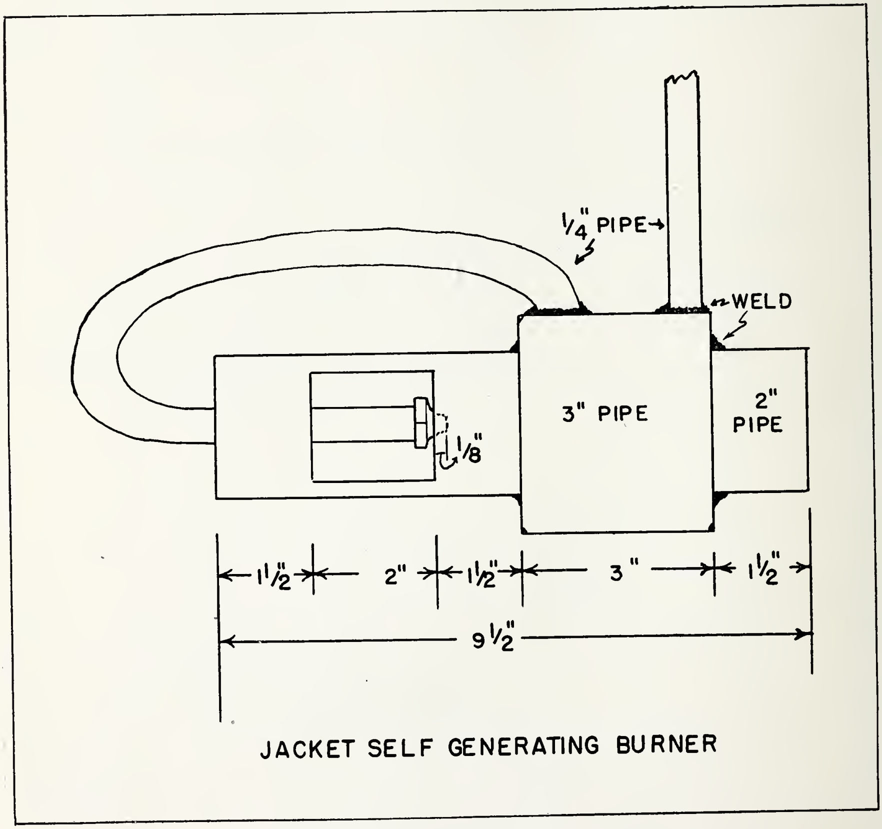


Figure 7. — Louisiana State University jacket self generating burner.

place around the burners to make an expansion or vaporizer chamber. In Figure 8 a piece of 1/4-inch black iron pipe is heated and coiled around the burner forming the vaporizer chamber. Both have been used successfully but the coiled pipe has given less trouble from scale getting into the tip.

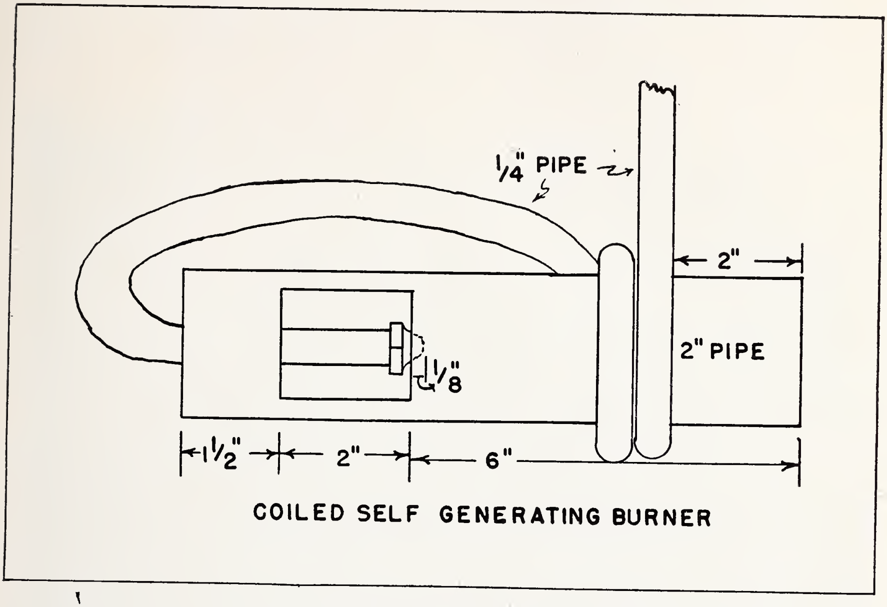


FIGURE 8. — Louisiana State University coil self generating burner.

Butane is more widely distributed than propane and lends itself to more uses, such as in the manufacture of artificial rubber; hence, it may be diverted to such use and command a higher price. Therefore, the equipment should be designed for the working pressure of 200 pounds that is required for propane. Butane requires a 100 pound working pressure; and if the equipment is designed for propane, then either may be used.

Comparison of Properties of Propane, Isobutane and Butane

Property	*Propane*	*Isobutane*	*Butane*
1. B. T. U. per cu. ft. of gas measured at 60°F. and atmospheric pressure (30 in. Hg.)	2,520	3,270	3,270
2. B. T. U. per lb. of gas	21,600	21,300	21,300
3. Range of inflammability of gas in air* per cent gas in air-gas mixture	2.4 to 9.5%	1.85 to 8.4%	1.8 to 8.4%
4. Vapor pressure, lbs. per sq. in. gauge			
at 60°F.	92	24	12
at 100°F.	172	59	37
5. Lbs. per gal. of liquid at 60°F, and storage tank pressure (vapor pressure at 60°F.)	4.24	4.70	4.86

6. Specific gravity of liquid at 60°F., water equals 1.00	0.509	0.564	0.584
7. Boiling point of liquid at atmospheric pressure	-44°F.	10°F.	32°F.
8. Cu. ft. of gas (60° F., atmospheric pressure) per lb. of liquid	8.59	6.51	6.51
9. Cu. ft. of gas (60°F., atmospheric pressure) per gal. of liquid measured at 60°F.	36.5	30.7	31.8
10. Specific gravity of gas, air equals 1.00	1.52	2.00	2.00

* "Limits of Inflammability of Gases and Vapors," H. F. Coward and G. W. Jones, U. S. Bureau of Mines, Bulletin 279.

In some sections of the country the liquified petroleum gas that is being sold is not pure propane, isobutane, or butane, but a mixture of these gases. The pressure in a cylinder of liquified gas depends not only upon the per cent of each gas in the cylinder but also upon the temperature. The characteristics of the various liquified petroleum gases can be understood better by referring to the above table.

With propane the rate of evaporation from a liquid to a gas without supplementary heat (70°F. outside temperature) was sufficient to keep two burners operating at full capacity until 3 per cent was left in a 20-gallon tank.

With a 3- or 4-row cultivator a tank of 70- to 120-gallon water capacity should be used, and then this tank can be filled to about 90 per cent with the propane or butane. Some form of vaporizer should be used with the 3- or 4-row machine in order to get uniform pressure to the burners. These vaporizers are heated by the exhaust or cooling water of the tractor engine, or by a small flame. Some vaporizers have automatic controls while others are regulated manually. It may be necessary to curtain the front of a tractor radiator on cool days in order to keep the tractor engine up to the best operating temperature (180°F. for gasoline or 200°F. for tractor fuel) if a hot water vaporizer is used. In using either a hot water or exhaust vaporizer the rubber hose or flexible metal pipe should be insulated in order to get the maximum heat to the vaporizer. When using an exhaust vaporizer, care must be taken that back pressure is not put on the engine or this may result in burned exhaust valves. Vaporizing of butane from a liquid to a vapor at the same temperature requires approximately 800 heat units (B.T.U.) per gallon of fuel.

The small user can perhaps best use the butane or propane in individual cylinders obtainable from a central "bottled gas service." The next step is to be close enough that the tank on the cultivator can be filled once per day by the butane or propane dealer. However, the most satisfactory plan for the medium and large users will be to have their own storage tanks, buy in large quantities and fill the tanks on their own equipment.

In most cases the difference between the pressure in the storage tank and the almost empty tank on the cultivator will cause the liquid gas to flow; however, a simple pump, either hand-operated or operated by an explosion proof electric motor, will speed up and give a quicker positive filling. These special pumps, storage tanks, etc., can be obtained from local liquified petroleum gas dealers. Many of the storage tanks are mounted on skids; however, elevating the tank, as shown in Figure 9, will aid in filling by gravity. It has become a common practice in Louisiana to allow the vaporized gas in the top part of the tank being filled to escape, reducing the tank pressure and speeding up gravity filling.

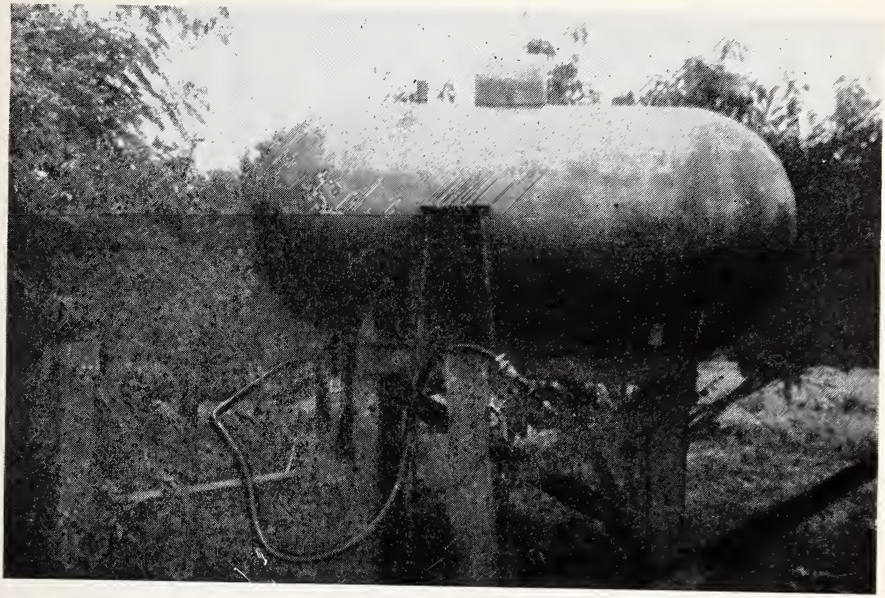


FIGURE 9. — Elevated farm storage tank for butane or propane.

However, in buildings, congested areas, and in some sections because of laws, a vapor equalizing hose is connected between the top of the tank being filled and the storage or delivery tank. If the equalizer hose is not used care should be taken that there is no open flame within 100 feet.

If one builds his own flame cultivator or buys a factory built complete unit, the pressure tank for liquified gas should be made according to the code specifications of either the A.S.M.E. or the A.P.I. - A.S.M.E., and should be built by some experienced and licensed manufacturer of pressure tanks. In addition to meeting the code on material and manufacturing, the tank must carry the necessary safety valve, filling valve, gauge, etc. The Louisiana law on liquified petroleum gases has several clauses designed for the safety of persons and property. One clause states that all containers for liquified petroleum gas must be sold and installed under the supervision of a bonded dealer in liquified petroleum gas.

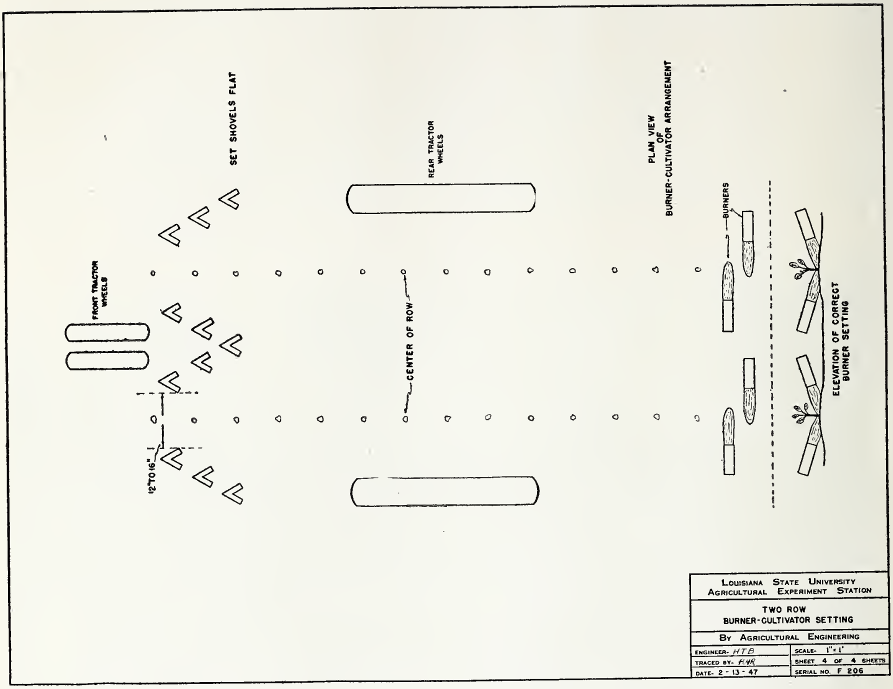

FRONT TRACTOR WHEELS
SET SHOVELS FLAT
12" TO 16"
CENTER OF ROW
REAR TRACTOR WHEELS
PLAN VIEW OF BURNER-CULTIVATOR ARRANGEMENT
BURNERS
ELEVATION OF CORRECT BURNER SETTING
LOUISIANA STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
TWO ROW
BURNER-CULTIVATOR SETTING
BY AGRICULTURAL ENGINEERING
ENGINEER- HTB
TRACED BY- HHR
DATE- 2 - 13 - 47
SCALE- 1" = 1'
SHEET 4 OF 4 SHEETS
SERIAL NO. F 206

FIGURE 10. — Suggested setting of sweeps and burners where both cultivating and flaming are being done in one operation.

SUMMARY

Set burners in a staggered design so that each row is flamed by two burners, one from each side. Do not let the flames meet, causing the flame to shoot up the plants, but arrange the burners close enough so as to relight one another.

Direct flame at the base of the plant.

Flame while grass and weeds are small.

Cotton should be at least 6 to 8 inches tall and 3/16 inch in diameter at ground line for first flaming. Sugarcane can be flamed from 4 to 6 inches tall.

Frequent scorching or light burning is better than a heavy severe burning.

Flaming and cultivation can be carried out simultaneously, either by mounting burners on cultivator beams, or cultivators in front of the tractor and the burners behind the tractor.

Hand hoeing can be eliminated except for chopping an occasional large weed.

Weeding by flame can be performed at one third or less as compared to the cost of hand hoeing.

Where there is a heavy growth of grass it may be necessary to flame at night or early in the morning on the second and third flamings. This is due to the fact that some of the grass is dead and dry, and during the day this grass would catch fire and damage the plant.

A better adjustment of the flame cultivator can be done at night as the flame path can be seen better then.

Set sweeps as flat as possible in order that flame can burn grass to the ground and not have a ridge of dirt partly protecting the grass. Suggested sweep and burner arrangement is shown in Figure 10.

Acknowledgments

The author wishes to acknowledge the valuable assistance of the following during this experiment: Bronier Thibaut, Napoleonville, La.; Ridgley LeBlanc, Napoleonville, La.; E. C. Woodyear, Mounds, La.; General Gas Corp., Baton Rouge, La.; and Petrolane Gas Co., New Orleans, La.

TECHNOLOGY AND SCIENCE [illegible]

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Louisiana Bulletin No. 416 April 1947

RICE DRYING AND STORAGE IN LOUISIANA

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RICE DRYING AND STORAGE IN LOUISIANA

During the past few years labor conditions have changed materially in the Louisiana rice territory. The binder and thresher are being gradually replaced by the combine. The shorter labor supply and the combine have made it more desirable to handle and store rice in bulk instead of by the conventional sack method.

Rice when combined generally contains from 2 to 17 per cent more moisture than rice that has been threshed. Normally, threshed rice contains from 13 to 17 per cent moisture and can be stored satisfactorily in sacks and bulk. A moisture content of 14 per cent or less is generally considered necessary for safe bulk storage; hence, the need for drying equipment to insure safe storage.

The conventional sack-storage structures are large sprawling buildings with raised floors that do not readily lend themselves to conversion into bulk storage. The following material is presented as a guide for the farmer in securing a better drier and storage structure.

Description and Characteristics of Rough Rice

Rough rice, also known as "paddy," "paddy rice," and "uncleaned rice," is threshed rice with the hulls on as it comes from the farm. Commercially, the term rough rice is used to designate the threshed rice when marketed for milling.

The seeds of the most common variety, Blue Rose, average 8.7 millimeters long and 3.4 millimeters in thickness, and 1,000 average kernels weigh 29.67 grams. The glumes are pale yellow and have smooth margins. The hull loosely encloses the kernel and is yellow and thick. Its surface has a burlap appearance and is thinly covered with long white hairs which are longer and more numerous toward the tip.

Rough rice with a moisture content of 14 per cent weighs on an average about 36.2 pounds per cubic foot. Some of the long grain varieties weigh slightly more but seldom exceed 38.6 pounds per cubic foot.

Respiration

A factor of considerable importance where rice is stored in bulk is respiration, which may be defined as the release of energy through biochemical oxidation of organic compounds. Respiration is continuous as long as life remains in the kernel. Carbon dioxide and water are the chemical end products, and in addition heat is liberated. Since rice itself is a poor conductor of heat, it follows that the heat released through respiration accumulates in the mass in proportion to its bulk, and the increase in temperature may reach a dangerous level.

The rate of respiration of rice at different moisture contents was determined at the University of Minnesota with samples of threshed rice obtained from a mill at Crowley, Louisiana. The results were as shown in the following table:

Respiration of Paddy Incubated at 37.8 Degrees Centigrade For Four Days.[1]

Moisture	CO_2 respired per 24 hours for each 100 grams of dry matter.
10.37%	0.27 mg.
12.15	0.32
13.22	0.51
14.12	1.01
14.93	2.20
16.11	8.22

[1] C. H. Bailey and A. M. Curjar, "Respiration of Rice Paddy and Milled Rice," *Journal of Biological Chemistry,* 44:9-12, October, 1920.

These data indicate that where rice is stored in bulk in any considerable quantity and for a considerable period of time, it should not have a moisture content greater than 14 per cent.

Moisture Content

To obtain data on the equilibrium moisture content of rice under South Louisiana conditions a sample of combined and artificially dried Blue Rose rice was obtained from a large bin of the Louisiana State Rice Mill at Lake Charles, Louisiana, in November, 1943. Its moisture content as it came from the bin was 14.1 per cent. It was stored in a burlap sack in the Agricultural Engineering laboratory at Louisiana State University, where it was exposed to atmospheric temperatures and humidities but was protected from direct contact with moisture. By March, 1944, its moisture content had dropped to 12.6 per cent, which indicates that under South Louisiana conditions, rice does not have a tendency to absorb moisture from the atmosphere in excess of the maximum of 14 per cent generally considered safe for bulk storage, as shown in the preceding table.

Rice that has been artificially dried is usually placed in storage at temperatures of from 10 to 40 degrees above that of the prevailing outside atmosphere. Under these conditions there is a tendency for moisture to transfer from certain parts of the bin and to accumulate at or near the top center of the mass. This same tendency has been observed with soybeans.[2]

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[2] Deane G. Carter and M. D. Farrar, "Redistribution of Moisture in Soybean Bins," *Agricultural Engineering,* 24:296, September, 1943.

Angle of Repose

The angle of repose for rice, or the coefficient of friction of rice on rice (*u*), was measured by filling a light wooden frame, mounted on a tilting top drafting table, with rice. The table top was then tilted until a part of the rice spilled over the lower edge of the frame, leaving an inclined surface which was the angle of repose for that particular sample. The inclined surface was measured by means of a plumb bob and protractor. The angle of repose was determined for the most common variety of rice, Blue Rose, and also for Rexoro, which is typical of the long grain rices.

It was found that angle of repose is greatly influenced by moisture content, especially when it exceeds 16 to 17 per cent. At higher moistures it increases very rapidly. The values given in the following table are for rice with 14 per cent moisture.

The results obtained were very consistent and for the same sample seldom varied more than plus or minus one per cent from the mean.

Angle of Repose for Rice

Variety	Angle of Repose, Degrees	Coeff. of Friction of rice on rice (tan. of angle)
Blue Rose	36	0.727
Rexoro	34	0.675

Coefficient of Friction

The coefficient of friction (*u'*) of rice on various bin materials is of particular importance to the bin designer because of its influence on bin pressures, and also on the required slope for hopper bottoms and any spouting to and from the bin proper.

The method used to determine the coefficient of friction was essentially the same as that for determining the angle of repose, except that a sample of the bin material to be tested was first placed between the wooden frame and the tilting table top. The bin material was fixed to the table top but the frame and contents were left free. The rice was carefully poured into the frame and leveled even with the top edges. The table was tilted until the angle was reached at which gravity overcame the frictional force between the rice and bin material, and movement began down the slope.

It was found that additional weight placed on the top surface of the rice had no significant effect on the angle at which movement began. This is to be expected, as the coefficient of friction is independent, within reasonable limits, of pressure per unit area.

Coefficient of Friction for Rice of 14% Moisture Content

	Blue Rose	Rexoro
Rice on flat galvanized iron	0.402-0.414	0.447-0.449
Rice on concrete (smooth finish)	0.516-0.531	0.461-0.473
Rice on wood (plywood, across grain)	0.495-0.500	0.530-0.542
Rice on wood (plywood, with grain)	0.435-0.440	0.500-0.506
Rice on wood (cribbed wall)	0.583-0.613	———

Ratio of Lateral to Vertical Pressures

The ratio of lateral to vertical pressure (*k*) for rice was determined with a small model bin two feet deep and one square foot in cross-sectional area. The bin was equipped with hydraulic-type pressure gauges at the side and bottom. When vertical pressure was applied at the top surface of the rice, the resultant pressure at the bottom and side could be determined by measuring the increased height of the water columns connected to the respective gauges.

A series of tests was made using gradually increased loadings up to a maximum of 868 pounds, which was the practical limit with the equipment being used. Figure 1 shows that *k* increases very rapidly at low pressures, but soon reaches and maintains a constant level for the remainder of the range of pressure applied.

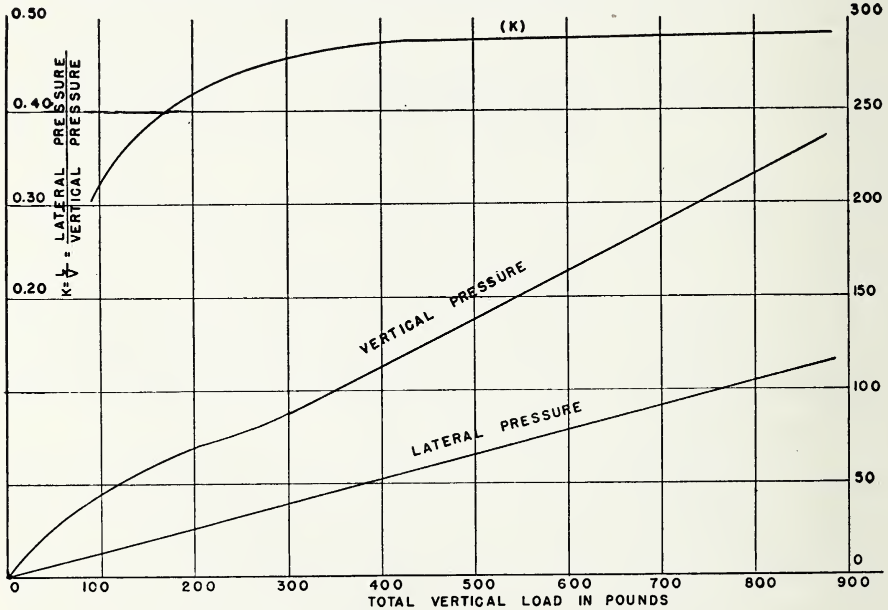

FIGURE 1. — Load pressures of rough rice in bins.

In examining the graph shown in Figure 1 it is noted that only about 27 per cent of the total vertical load was transmitted through the two-foot column of rice to the bottom gauge. This surprising result was verified by several tests in which the walls of the bin were supported separately from the floor, while the bin bottom only rested on a platform scale. This experiment also checked the accuracy of the pressure gauge, in that the pressure indicated by the water column checked very closely with the actual pressure as shown by the platform scale.

General Requirements of Rough Rice Storage Bins

A bulk storage system for rice must have a sufficient number of bins to store each variety separately. Since the average rice grower will ordinarily grow as many as four different varieties, to spread his harvesting season over a longer period, a minimum of four bins is required in the most simple system. Where an artificial drier is used, additonal work bins are needed for storage of partially dried rice. As a general rule from ten to fourteen bins should be provided where the total capacity does not exceed 10,000 barrels.

The most popular rice combines now in use have a maximum daily harvesting capacity of about 250 to 300 barrels. Combined rice must be artificially dried, and it is common practice to dry the rice from two to four separate times on consecutive days. It is believed that one combine will have sufficient capacity for the average rice grower in Louisiana. Where this is the case four working bins should be provided, each of about 250 to 300 barrels capacity.

The commercial rice driers now available require a space about 16 feet by 22 feet by 40 feet high. To accommodate a drier of this height the work house (part of structure in which drier and elevators are located) must be about 50 feet in height. Where a work house of this height is used, it is economical to construct the storage bins a minimum of 30 feet deep rather than of less depth and greater cross-section, thus simplifying to some extent the conveying system.

Since the rice must be frequently moved the labor required for this should be reduced to a minimum. All bins should be hoppered at the bottom so they will empty entirely by gravity. For dry rice a 45 degree slope is satisfactory where the valley angle is lined with smooth tin. For bins which will handle damp rice, such as the working bins, the hopper slope should be increased to 60 degrees.

Rice is a granular material. The pressures exerted by it when stored within a bin do not follow the laws of fluid pressure. In order to check the laboratory analysis, gauges were installed in the bulk storage plant of the Louisiana State Rice Mill at Lake Charles, where there are rice bins 65 feet deep. The test bins were filled 52 feet deep with Blue Rose five times and Rexoro three times. The rice was all of good quality and had a moisture content ranging from 13.9 to 14.2 per cent. The result of these tests indicated that the walls were carrying 87.2 per cent of the total weight of the contents, while only 12.8 per cent was carried by the bottom of the bins.

Handling and Conveying Equipment

The conveying and elevating equipment for a bulk handling plant is very important and deserves careful study. This equipment receives a great deal of use and in any case should have a capacity equal to that of the drier. For a small bulk storage an 8" x 5" cup with a 9" auger is about the minimum size. In most installations where a drier is used a minimum of three elevators is desirable — one for moving rice from the unloading pit to drier or bin, one from the drier to bins, and another from bin to drier or bin to bin. With this arrangement it is possible to unload rice from the combine at the same time other rice is being dried. Where a double row of bins which are individually hoppered at the center is used, a fourth elevator is desirable, which will permit "loading out" rice into trucks or box cars at the same time other operations are going on.

To prevent undue mixing of rice varieties, all elevator boots and conveyors should be made readily accessible for cleaning. Experienced rice buyers can readily detect if there is even a small amount of another variety mixed in the rice they are buying, and usually they discriminate rather severely against it.

An unloading pit should be provided for rice coming in for storage. A concrete pit with a ramp leading toward and away from it makes a good arrangement. It can be covered with a grating and provided with some type of hoist for dumping the rice from truck or trailer. The slope of the hopper bottom should be a minimum of 60 degrees. Where a pit is used, care must be taken during construction to insure a waterproof job.

Combined rice often contains considerable foreign matter with a high moisture content, such as short lengths of straw and pieces of green leaves and berries from weeds. This, if allowed to remain, may give trouble by preventing a uniform flow of rice through the drier and, later, by tending to cause heating in storage. It is advisable to use some type of cleaning device for removing this material. A machine such as No. 6 Monitor Cleaner is of about the right size for the smaller storage plants.

Fundamentals of Rice Drying

Combined rice normally contains about 14 pounds of excess water per barrel, which must be removed before the rice can be satisfactorily stored or milled. This excess water could be removed as a liquid by means of a very powerful press, but this would obviously be impractical. A more practical method is to evaporate the excess moisture and remove it as a vapor.

Evaporation requires energy in the form of heat. To evaporate one pound of water from rice requires, in round numbers, about 1,000 BTU of heat, or the total heat required to dry one barrel of combined rice is equal to that required to raise the temperature of about 14,000 pounds of water one degree Fahrenheit. Nature supplies this same amount of heat to rice dried naturally in the shock in the field from the vast amount of energy supplied by the sun.

The most practical method for artificially removing the excess moisture is to pass warm air through the damp rice. The heat from the air supplies the energy for evaporation and at the same time tends to maintain a greater vapor pressure within the rice grain than exists on the exterior. This difference in vapor pressure largely governs the rate at which moisture will move from the interior to the exterior of a rice grain.

Another important function of the warm air is to provide a medium for carrying away the water vapor liberated by evaporation. The amount of water vapor which air can hold or transport is governed by its temperature. A pound of air which is saturated at ordinary atmospheric temperature can be made to carry an additional amount of vapor equal to what it already has by raising its temperature 25 to 30 degrees Fahrenheit.

The humidity of the air in South Louisiana is usually high. About 2,000 cubic feet of warm air are required to absorb and carry away one pound of water vapor, or about 28,000 cubic feet are needed to dry one barrel of rice.

There are a number of factors which govern the rate at which water can be evaporated from rice. Surface moisture which is present when the moisture content is high is very easily removed as the evaporation takes place from a free water surface. Internal moisture is more difficult to remove, as the diffusion of moisture to the surface is relatively slow, owing to the dense kernel and somewhat impervious hull of the rice grain. The deviation of the drying rate from the rate of free evaporation will depend upon the time required to bring the moisture to the surface. Diffusion of moisture to the surface will be quite rapid at first, but as drying advances, the process becomes slower until a condition of equilibrium is reached and further evaporation ceases. The ultimate rate of drying is thus governed by the rate of both evaporation and diffusion.

To reduce the total time for drying to a minimum and thereby increase the capacity of the drier, it is good practice to expose rice to drying air at intervals. After the surface moisture has been evaporated the rice is placed in storage for a time until the moisture has again become evenly distributed throughout the grain. It is then again exposed to the drying air.

Since heat is needed in drying, both to supply energy for evaporation and to maintain a difference in vapor pressure which causes internal moisture to diffuse to the surface, the drying air temperature should be as high as possible without damaging the rice. The upper safe limit for this temperature is probably about 130 degrees Fahrenheit.

Warm air, which supplies heat for drying and carries away moisture, should be supplied at the rate of 350 to 400 cubic feet per minute for each barrel of rice being dried. The practical limit for the relative humidity of the air leaving the drier is about 75 per cent. To obtain uniform distribution of air throughout the drier without excessive static pressure, it is important that the lineal velocity of the air in the ducts does not exceed 2,000 feet per minute. When this precaution is observed, the static air pressure at the blower need not exceed ¾ inch water pressure.

Evaporation requires heat. Where the heat is largely supplied by warm air passing through the rice, the greater the rate of evaporation, the greater the drop of temperature between the inlet and outlet air. The temperature of the air will drop approximately 8½ degrees Fahrenheit for each grain of moisture absorbed per cubic foot of air measured at 70 degrees, or 0.64 of a degree for each grain absorbed per pound of air, where no heat has been lost to the rice or drier itself. As the drying rate decreases, there is less cooling of the rice by evaporation and finally the temperature of the rice and the outlet air will increase and gradually approach the temperature of the inlet air. These temperatures are the best indication of what is actually happening to the rice in the drier and should be closely observed by the drier operator.

It is recommended that the temperature of the rice should not be allowed to exceed 110 degrees Fahrenheit for best drying results. This temperature can be determined by catching a sample of the rice from the drier in a container and inserting the bulb of an ordinary laboratory thermometer into the interior of the sample.

Rice Drying Instructions

A. Start with good quality rice.
   1. Rice should not be chalky, pecky, etc.
   2. Rice should be of uniform ripeness. Overripe grains usually are sunchecked.
   3. Rice should be well combined and have a minimum of hulled grains.
   4. Rice should be combined at 22 to 26 per cent moisture content.

B. First drying.
   1. Begin within six hours after combining.
   2. Dry for 30-45 minutes at 130 degrees Fahrenheit.

C. Second drying.
   1. Begin 6 to 12 hours after completion of first drying.
   2. Dry for 20-30 minutes at 130 degrees Fahrenheit.

D. Third drying and additional dryings required to reduce the moisture to 14½ per cent.
   1. Begin 6 to 12 hours after completion of previous dryings.
   2. Dry for 20 minutes at 130 degrees Fahrenheit.

E. Last drying.
   1. Begin within 24 hours after previous drying.
   2. Dry without artificial heat unless atmospheric humidity is above 75 per cent.
   3. Dry until rice temperature is as low as the atmospheric temperature.

Low Yield of Head Rice

Occasionally a lot of artificially dried rice is received at the mills which yields fewer pounds of head rice than is normal for that variety.

Investigation of the reasons for the low milling yield usually reveals one or two causes. The rice kernel may be fractured in the drier either by too rapid drying with excessive heat or by too rapid cooling. In most cases, however, where a sample of the original rice that was dried naturally is available for comparison, it is found that the quality of the rice was poor when it first reached the drier.

The common complaint is that the rice has been stack burned by the drier. Stack burning is occasionally found in artificially dried rice but does not occur in the drier. Experimental work conducted by research workers at the University of Minnesota* and others shows that certain molds, bacteria, and fungi are almost invariably present on normal rice grains even though the rice has been grown and harvested under ideal conditions. Their presence is entirely harmless as long as conditions are unfavorable for their growth. When the moisture content exceeds the minimum for the reproduction of these organisms and the temperature conditions are suitable, abundant growth is produced. This condition prevails when the relative humidity of the air surrounding the rice grains reaches or exceeds about 75 per cent at a minimum temperature of about 77 degrees. Growing organisms produce moisture and heat as end products of their respiration and also excrete powerful digestive ferments which act on the starches, proteins, and fats, which are readily available near the bran layer of the rice grain.

The occurrence of stackburn can best be prevented by limiting the length of time between dryings. The practice of allowing the temperature of rice to rise in the bin is not recommended. The temperature of dried rice should be reduced to atmospheric temperature before it is placed in final storage.

Weight Loss Due to Drying

When rough rice is dried artificially or naturally in the shock in the field, there is always a loss of weight. The loss of weight is due to the removal of moisture, and the percentage of loss of weight due to drying is always greater than the reduction in the percentage of moisture. This difference exists because as the rice is being dried there is a constant change of base in making the moisture test.

The algebraic calculations for the final weight of a barrel of rice, after drying, may be made as follows:

$$\text{Final wt.} = \text{original wt.} - \text{wt. lost due to drying} \qquad (1)$$

$$\text{Wt. lost due to drying} = (\text{original wt. x original \% moisture}) - (\text{final wt. x final \% moisture}) \qquad (2)$$

As an example, assume 162 pounds of rice are dried from 24 per cent to 14 per cent. Transposing these values into equation (2) and then in turn into equation (1), we have:

$$\text{Final wt.} = 162 \text{ lbs.} - (162 \text{ lbs. x } 0.24 - \text{final wt. x } 0.14)$$

$$\text{Final wt.} = 162 \text{ lbs.} - 38.88 + 0.14 \text{ final wt.}$$

$$\text{Final wt.} = \frac{162 - 38.88}{0.86} = 143.16 \text{ pounds.}$$

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* Max Milner, Minnesota Agricultural Experiment Station.

Note that in this case the reduction in moisture is 10 per cent while the reduction in weight due to drying is 11.63 per cent.

Another form of the same equation which is more easily remembered is as follows:

$$\text{Final wt.} = \frac{\text{original wt. x original \% dry matter}}{\text{final \% dry matter}}$$

$$\text{Final wt.} = \frac{162 \text{ lbs. x } (100\% - 24\%)}{(100\% - 14\%)} = \frac{162 \text{ x } 76\%}{86\%} = 143.16 \text{ lbs.}$$

In addition to the weight lost due to drying there is usually some loss due to the blowing out of small particles of broken grains, dust, and hulls. Where the rice is cleaned during the drying process additional straw, weed seeds, and foreign material are removed and the total weight loss may be as much as 2 per cent for each per cent of moisture removed by the drier. The average weight loss on over 69,000 barrels of rice dried at the Crowley Rice Drier Co-op., Inc., Crowley, Louisiana, during the 1945 drying season was 9½ per cent.

Cleaning Combined Rice Before Drying

Combined rice usually contains varying amounts of straw, grass, weed seeds, etc., which add considerably to the total moisture of the sample. As an example, moisture tests made on an exceptionally dirty lot of rice showed the average moisture to be 37½ per cent. The rice only was then removed by hand from the same sample and it was found to contain only 22 per cent moisture. The wet foreign material in combined rice not only cuts down on the capacity of the drier, but also interferes with the uniform flow of the rice in the drier, bins, and conveying system.

Combined rice which has not been dried is difficult to clean. Many of the weed seeds will pass through the same size screen opening as rice, and when wet are too heavy to be removed by air. One of the greatest problems is to obtain sufficient cleaning capacity in barrels per hour without excessive cost for cleaning equipment.

A coarse screen is probably the best for removing the larger pieces of straw and other material which interfere with the uniform flow of rice. One of the best commercial cleaners observed uses a revolving screen cylinder for removing the larger pieces and an air blast for the smaller and lighter dust, chaff, hulls, etc.

When rice is artificially dried, a great deal of dust is produced. This is because the rice hulls and other foreign matter are more porous or smaller than the rice kernel itself and become very dry and brittle. The transferring of rice from bin to drier and return causes these brittle pieces to break up into smaller pieces. Some varieties of rice such as Blue Rose have a fuzz on their hull which when dry is easily rubbed off.

Screen Analysis of Dust Obtained at the Crowley Rice Drier Co-op., Inc., Crowley, La.

Sample A. Settled dust from ledges near drier.

Sample B. Settled dust deposited by air currents only.

	Sample A	Sample B
Through 325 mesh	25.3%	49.7%
325 - 200 mesh	18.9%	23.3%
200 - 100 mesh	7.2%	18.4%
100 - 65 mesh	9.4%	4.0%
Under 65 mesh	39.2%	4.6%

Dust Control in the Drying Plant

To avoid much of the annoyance and inconvenience of dust, it is recommended that all driers be enclosed. The drier enclosure should be large enough to act as a settling chamber to remove the heavier particles of dust from the air stream. The exhaust opening from the drier enclosure should always have an area at least equal to the total area of the blower outlets leading into the enclosure. This is necessary to avoid back pressure on the blower.

Where better separation of dust from the drier air is necessary than is possible with a simple settling chamber, an air washer is recommended. The greatest factor in the elimination of dust in an air washer is a properly designed scrubbing surface wetted and washed down with low pressure water sprays. The air flowing through the washer should be divided by the scrubbing plates into as narrow layers as practical in order that as great a contact surface as possible may be secured, and so that the dust particles in the air will have a relatively small distance to travel before coming in contact with a wetted surface. In addition to the scrubbing plates, it is advisable to provide a chamber with water spray so arranged that the spray is directed toward the plates and in the direction of the air flow. The water should be supplied with a settling tank, through which the spray water is recirculated to remove dust particles. Provision should be made for quickly draining and refilling the settling tank, as this must be done periodically. A centrifugal pump is used to circulate the spray water.

A source of much of the dust in a drying plant is the elevator discharge of partially dried rice into the receiving hopper of the drier. Most of this dust and larger foreign material such as dry straw can be removed here by passing the rice through an aspirator.

Another source of dust is at the discharge of the drier. This dust is produced by the movement of the rice in passing through the drier. Since it is very dry and consists mostly of very small particles it is easily removed by air. In most cases a suction applied to the discharge spout leading from the drier to the elevator will be sufficient.

Where dust is systematically removed from the rice at the locations mentioned, it does not have a chance to accumulate. By placing covers on the conveyors most of the remaining dust is prevented from escaping.

Where complete dust control is necessary or desired the recommendations given in U. S. D. A. Department Bulletin 1373, "Dust Control in Grain Elevators," will be found very helpful.

Another very good reference on dust control is Engineering Service Department Bulletin No. DC-200A, which can be obtained from the Mill Mutual Fire Prevention Bureau, 400 West Madison Street, Chicago, Illinois

Those interested in the explosive properties of rice dust are referred to U. S. D. A. Technical Bulletin No. 490, "Explosibility of Agricultural and Other Dusts as Indicated by Maximum Pressure and Rates of Pressure Rise," or they may obtain more recent information by writing direct to Mr. Hylton R. Brown, Senior Engineer, U. S. Department of Interior, Bureau of Mines, Eastern Experiment Station, College Park, Maryland.

Moisture Testers

The principal advantage of the electric type testers is in the rapidity with which tests can be made. For this reason they are very popular with rice drier operators, who need to know at all times the approximate moisture content of each lot of rice. These testers have been calibrated with clean rice of uniform moisture content, and when testing such rice are very accurate. Wet combined rice is seldom uniform in moisture content and usually contains varying amounts of weed seed of high moisture content, which makes it very difficult to obtain a true average moisture reading. Rice which has just passed through a drier is not of uniform moisture throughout the entire grain, and unless allowance for this is made the true moisture is not obtained. For this reason some drier operators have been led to believe that moisture content of rice changes appreciably while in the bin between dryings.

The Brown-Duvel tester, if properly operated, will give the true moisture of a sample of rice regardless of foreign matter, temperature of the rice, or uniformity of drying. The principal disadvantage of this tester is that about 30 minutes is required to complete a moisture test. Complete instructions for the operation of this tester are given in U. S. D. A. Bulletin No. 1375D, "The Brown-Duvel Moisture Tester and How to Operate It."

All types of moisture testers are calibrated and checked by oven drying a part of the sample being tested. This method is extremely accurate and is standard for all types of moisture tests, but requires considerable time. Information on the procedure for making this type of test is given in U. S. D. A. Agricultural Marketing Service, Service and Regulatory Announcement No. 147, "Air-oven and Water-oven Methods Specified in the Official Grain Standards of the United States for Determining the Moisture Content of Grain."

Seed Rice Drying

Seed rice may be dried artificially without damage to the germination. Very good results have been obtained in experimental work by continually rotating the seed rice from bin to drier and then to another bin until dry. An inlet air temperature of 120 degrees Fahrenheit and a 20-minute drying period were used. This method of drying reduces the capacity of the drier somewhat but eliminates the possibility of mold or fungus attacking the germ of warm damp rice while in the bin between drying periods.

Before drying a lot of seed rice it is extremely important that the drier, bins, and conveying system be thoroughly cleaned in order that there will be no mixing with other varieties. The seed rice drier should be of a self-cleaning type. The bins should be free of projections or ledges on the interior, and the elevator boots easily cleaned. Screw conveyors can be cleaned with a small portable electrically driven hand blower. The dust covers are removed, and with the conveyor running, cleaning is started at the receiving end and proceeds to the discharge end. As rice is piled up by the blast of the blower, the next conveyor flight picks it up and carries it to the discharge end.

Heat Supply For Drier

The amount of heat required for warming the air used by a rice drier depends upon the initial temperature and moisture content of the air. The approximate quantity of heat required to raise the temperature of one pound of air and its moisture one degree Fahrenheit is about 0.246 BTU per pound of the mixture, or about 18.1 BTU per 1000 cubic feet of air.

The average mean temperature in the Crowley, La., area during August, September, and October is about 77 degrees Fahrenheit. Assuming 77 degrees Fahrenheit initial temperature, 130 degrees maximum temperature, and with no heat loss, a total of about one BTU of heat is required per minute for each cubic foot of air used by the drier.

To take care of lower initial air temperature, heat losses, and periods of above average humidity, it is recommended that enough heating capacity be provided to supply about two BTU per minute for each cubic foot of air used.

The most satisfactory source of heat for a rice drier is natural gas or butane gas. Gas burners are relatively inexpensive and are easily regulated to maintain a desired air temperature. Because a clean flame is produced, the burner can be directed toward the inlet to the blower and the products of combustion allowed to pass through the drier.

Gross Heating Value of Various Fuels

Natural gas	1,000 BTU per cu. ft.
Commercial butane	21,180 BTU per pound
	102,600 BTU per gallon
Commercial propane	21,560 BTU per pound
	91,500 BTU per gallon
Gasoline	21,050 BTU per pound
	129,000 BTU per gallon

Kerosene	20,000 BTU per pound 135,000 BTU per gallon

As a safety precaution each burner installation should be equipped with a solenoid valve in the gas line. During normal operation the solenoid valve is held open by electrical energy from the same circuit which drives the blower motor. It should be wired so that in case of current failure the valve is automatically closed and remains closed until manually opened by the drier operator.

Experimental Work on Drying Plants

Preliminary work on the requirements of an inexpensive individual type farm rice drier was begun during the 1943 rice harvest season. At that time experiments were conducted and data collected, on a full season's drying results, at an existing plant owned and operated by Webster Todd and Donald Todd near Holmwood, Louisiana. The results of the first season's research provided valuable information on the drying conditions which must be maintained in a drier to ensure a maximum yield of head rice.

Following the 1943 harvest season, work on the design of a drier was begun. The following principles were kept in mind:

1. With optimum drying conditions known and maintained in the drier, each grain of rice should, as far as is mechanically practical, be uniformly exposed to those same drying conditions.
2. The drier should be easy to fabricate with standard types and sizes of materials most readily available.
3. The drier should be easily constructed without an elaborate set of tools and equipment.
4. The drier should be entirely self-cleaning, making it suitable for the drying of seed rice.
5. The drier should be of a size suited to the needs of the small grower.

The first experimental drier was built during the summer of 1944. The construction of the drier is best shown by referring to Figure 2, a picture of a one-fourth-scale model of the drier, and to Figures 3 and 4. During the early part of the 1944 harvest season, it was installed on the farm of John Baker and Floyd Baker near Gueydan, Louisiana. The picture of the scale model shows one side of the inlet air duct constructed from transparent plastic material. In the large model this was replaced with ¾-inch plywood.

Four 300-barrel-capacity round tanks of light gauge steel construction were used for working bins. A receiving hopper for wet rice, two elevators, and necessary screw conveyors were provided. Heat for the drier was supplied by a homemade burner using natural gas. A 7½ H.P. electric motor supplied all of the power for the elevators and conveyors.

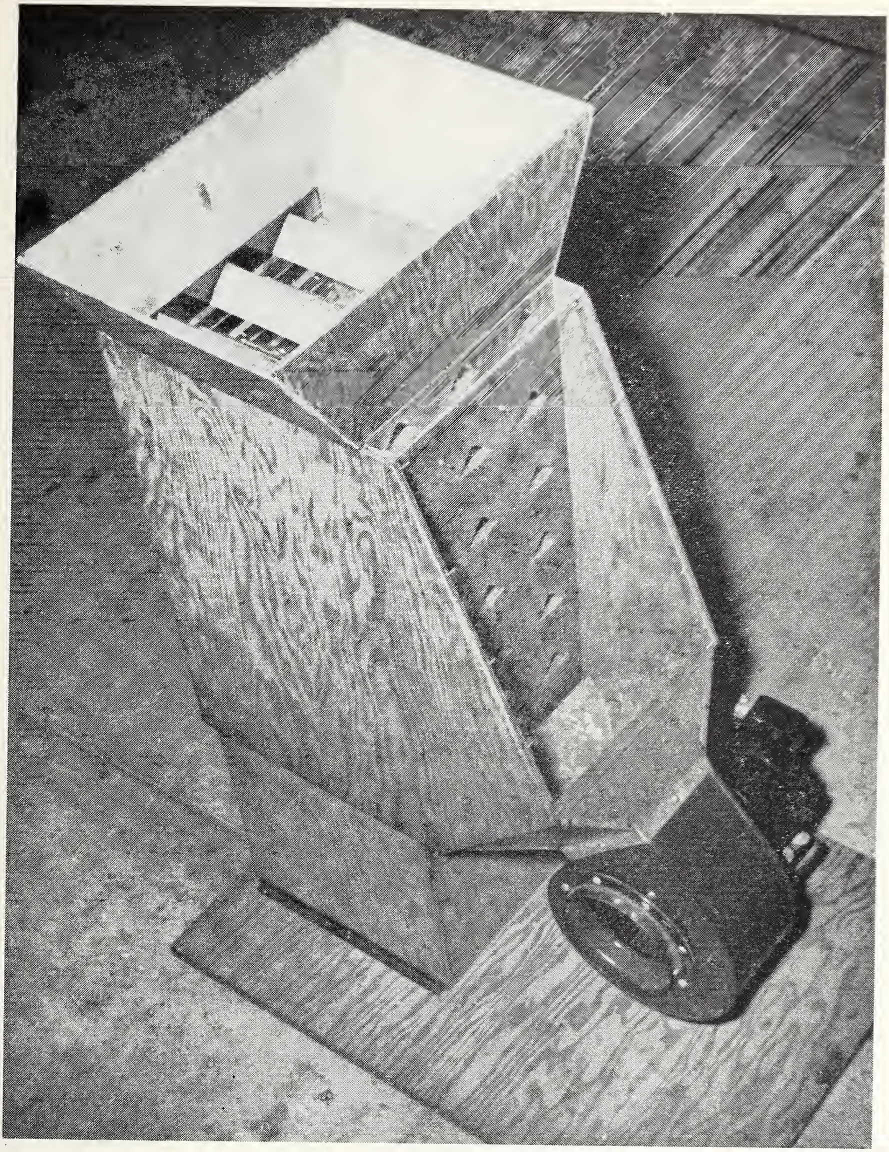

Figure 2. — Picture of a one-fourth-scale model of the drier.

About 10,000 barrels of rice were dried that season at a cost of 18 cents per barrel. The total cost of the plant was estimated at $5,500.

As a result of the research at Gueydan, a second drying plant was erected the following year by Remy Robert and Bros. at Burnside, Louisiana, as shown in Figure 5. The drier is of the same design shown in Figures 3 and 4, except that it is larger and of steel construction. Plans

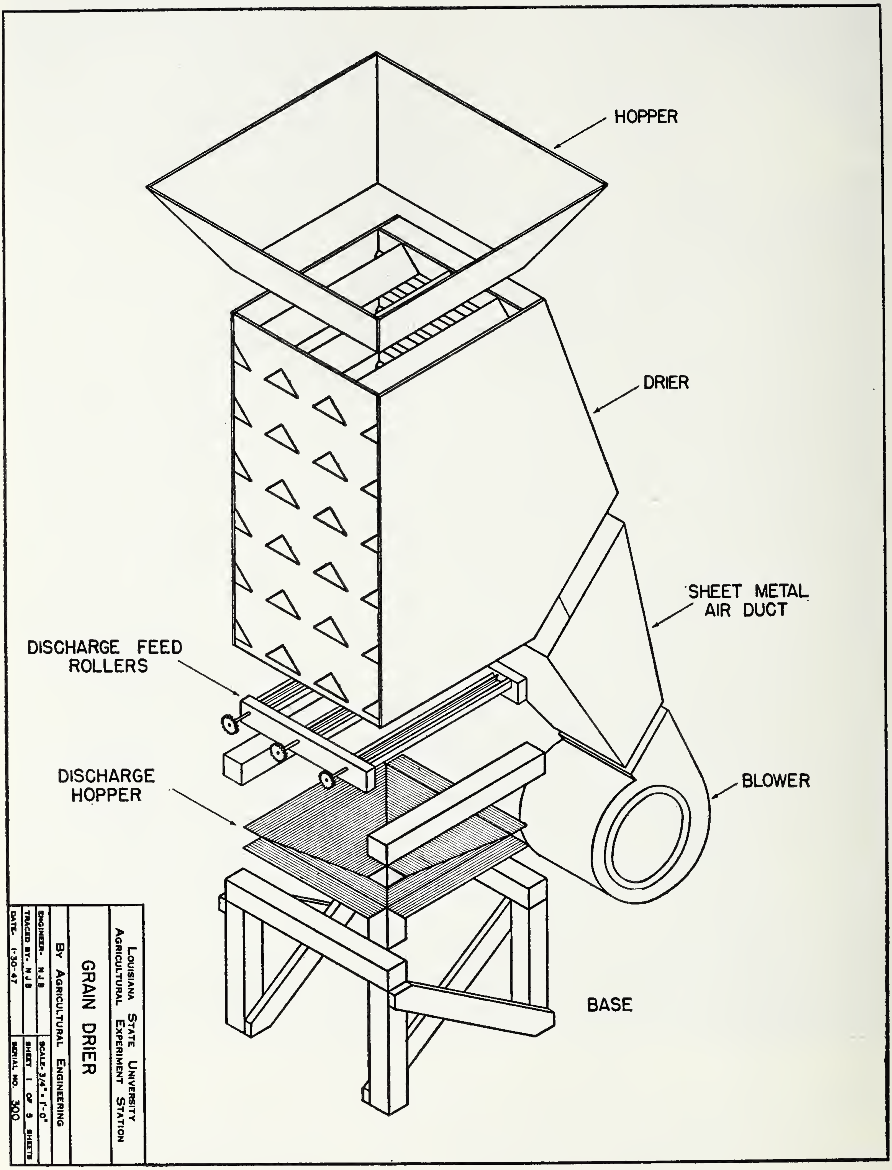

FIGURE 3. — Exploded isometric view of rice drier.

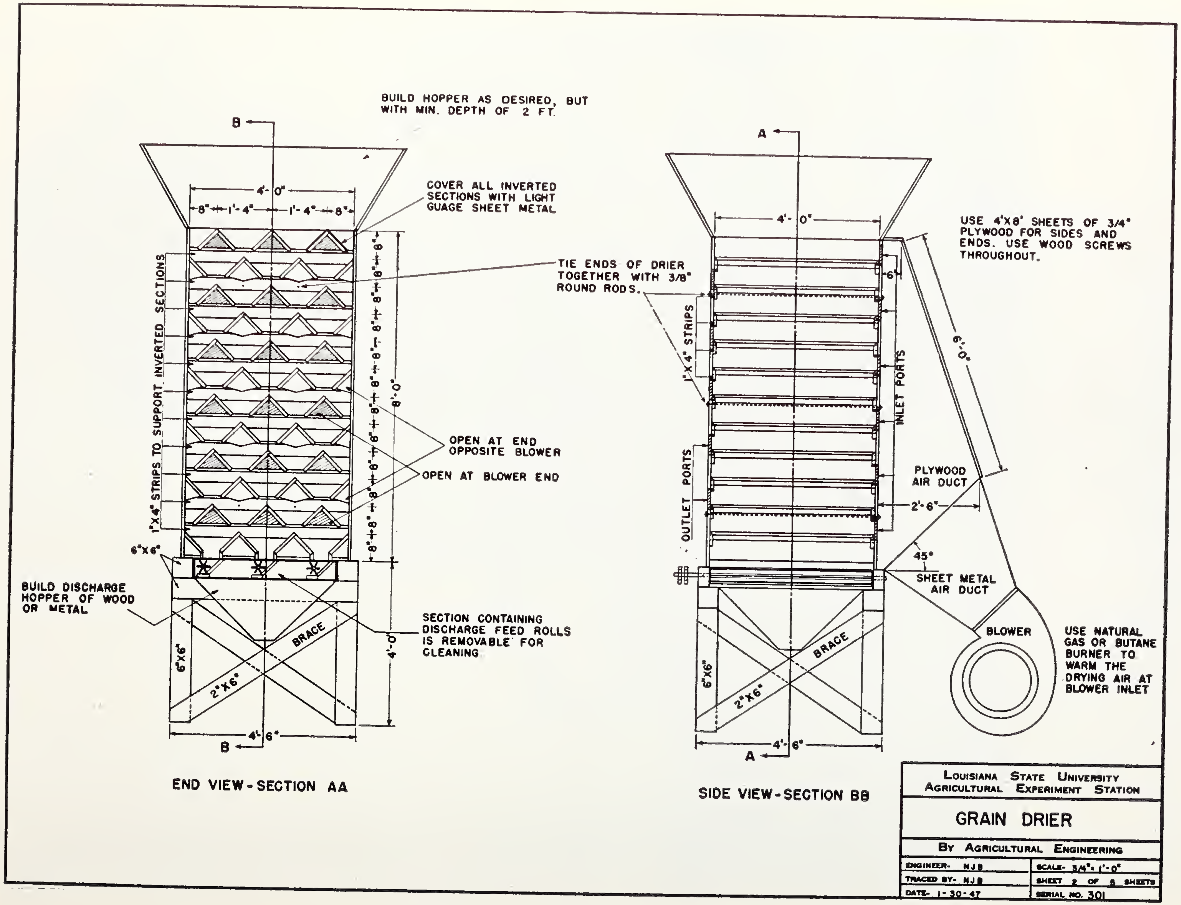
BUILD HOPPER AS DESIRED, BUT WITH MIN. DEPTH OF 2 FT.
B
4'-0"
8" 1'-4" 1'-4" 8"
COVER ALL INVERTED SECTIONS WITH LIGHT GUAGE SHEET METAL
1"X4" STRIPS TO SUPPORT INVERTED SECTIONS
TIE ENDS OF DRIER TOGETHER WITH 3/8" ROUND RODS.
8" 8" 8" 8" 8" 8" 8" 8" 8" 8" 8" 8"
8'-0"
OPEN AT END OPPOSITE BLOWER
OPEN AT BLOWER END
6"X6"
BUILD DISCHARGE HOPPER OF WOOD OR METAL
SECTION CONTAINING DISCHARGE FEED ROLLS IS REMOVABLE FOR CLEANING
BRACE
6"X6"
2"X6"
4'-0"
4'-6"
B
END VIEW - SECTION AA
A
4'-0"
USE 4'X8' SHEETS OF 3/4" PLYWOOD FOR SIDES AND ENDS. USE WOOD SCREWS THROUGHOUT.
6"
1"X4" STRIPS
INLET PORTS
OUTLET PORTS
6'-0"
PLYWOOD AIR DUCT
2'-6"
45°
SHEET METAL AIR DUCT
BLOWER
USE NATURAL GAS OR BUTANE BURNER TO WARM THE DRYING AIR AT BLOWER INLET
BRACE
6"X6"
2"X6"
4'-6"
A
SIDE VIEW - SECTION BB
LOUISIANA STATE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
GRAIN DRIER
BY AGRICULTURAL ENGINEERING
ENGINEER- NJB
TRACED BY- NJB
DATE- 1-30-47
SCALE- 3/4"= 1'-0"
SHEET 2 OF 5 SHEETS
SERIAL NO. 301

FIGURE 4. — Section views of rice drier.

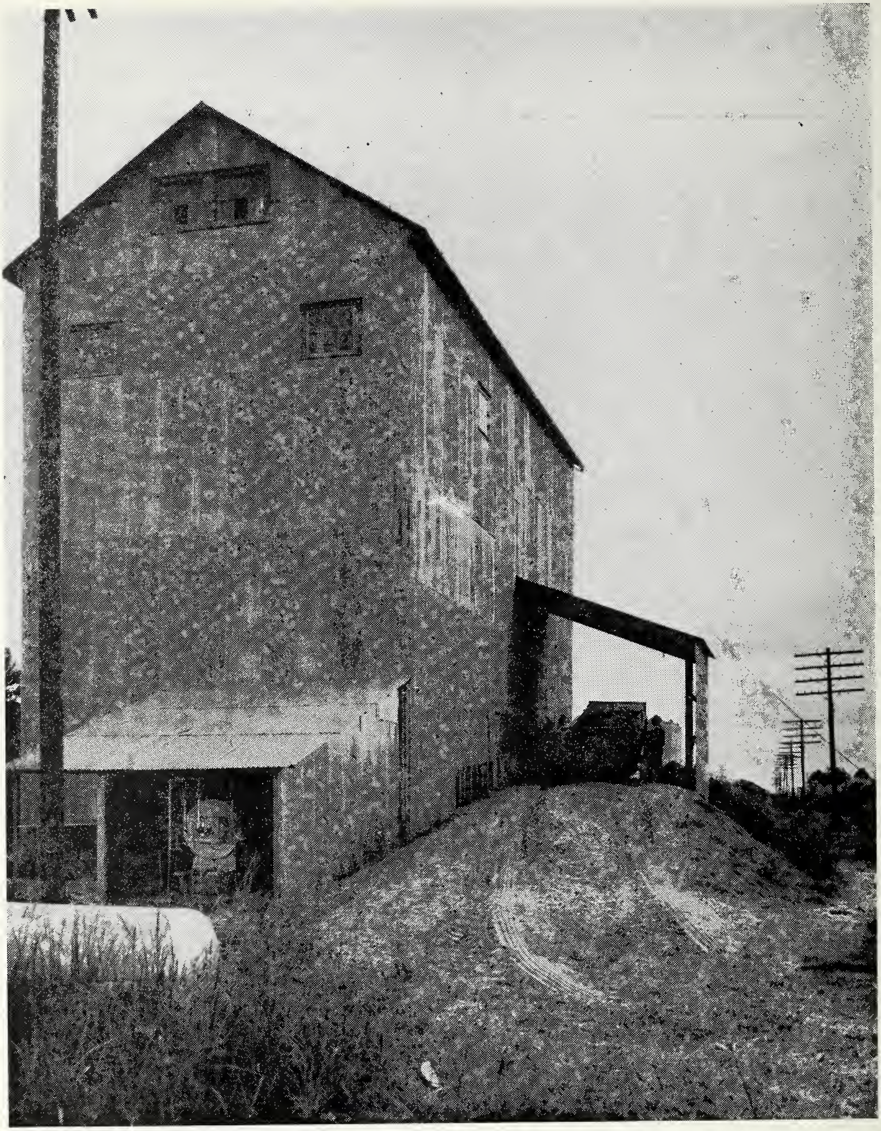

Figure 5. — Rice drier and storage of Remy P. Robert and Bros., Burnside, La.

for the drier, elevators, conveying system, bins, and layout of the complete plant were supplied by the Experiment Station. In order to test out the feasibility of using steel bins for storage of rice, a test was made in cooperation with Remy P. Robert.

Approximately 200 barrels of Blue Rose rice were combined, dried and put into a round cylindrical steel bin 11 feet 4 inches in diameter with a conical-shaped hopper on November 28, 1945. This rice was not disturbed during the storage period and was in good condition when removed on April 15, 1946. Results of this test indicate that steel bins are satisfactory for the storage of rice, as shown by data in the following table.

Temperature and Moisture Data on Rice Stored in Steel Bin

Thermocouple Location	1945			1946					
	11-28	12-10	12-18	1-4	1-17	2-1	2-19	3-8	4-15
	Temperature in degrees F.								
Center, 6 ft. below surface	100	69	64	58	54	54	52	55	61
Center, 3 ft. below surface	96	71	66	58	56	55	53	54	62
Center, 3 in. below surface	91	70	58	58	44	49	55	61	68
4 ft. from side, 3 in. below surface	77	79	58	58	47	54	63	64	71
3 in. from side, 3 in. below surface	95	57	47	56	52	57	65	64	70
Air 6 ft. above rice	81	50	57	68	53	60	64	64	74
Sample Location	Moisture in per cent determined by oven drying								
Center, 3 in. below surface		17.47		16.82	15.68	15.30	15.56	14.78	14.31
3 in. from side, 3 in. below surface		17.12		16.72	16.15	15.63	15.68	14.99	14.54
3 in. from side, 36 to 48 in. below surface				16.02	15.80	14.63	14.78	14.15	14.07
Bottom outlet gate					13.80	13.02	13.48	12.80	12.70

The following bill of material gives the materials from which a farmer can fabricate the drier easiest. If plywood is not available, tongue and grooved dressed lumber can be substituted. The entire drier can be and has been built of sheet iron, angles, rods, and piping; its construction, however, requires tools and machine for working steel not found on many farms.

Bill of Material for Building Small Grain Drier*

7 sheets	—4' x 8' plywood, ¾" thick, 5-ply, for ends and sides
24 pcs.	—dressed lumber, 1" x 10" x 12', for inverted sections
8 pcs.	—dressed lumber, 1" x 4" x 12', for supporting ends of inverted sections
1 pc.	—dressed lumber, 1" x 10" x 12', for supporting lower row of inverted sections
2 pcs.	—dressed lumber, 1" x 3" x 12', for braces
4 sheets	—4' x 8', 20 gauge galvanized sheet metal, for air duct from blower to drier
8 ft.	—⅛" x 1" strap iron, for attaching metal air duct to blower
6	—round rods ⅜" x 4'6", threaded at each end and with nuts and washers

6 sheets—4' x 10', 28 gauge galvanized sheet metal, for covering inverted sections (Use leftovers to cover boards in discharge feed roller section)

Receiving Hopper

4 sheets—4' x 8' plywood, ¾" thick, 5-ply
36 ft. —⅛" x 1" strap iron, for reinforcing hopper and attaching to drier

Discharge Feed Roll Section

1 pc. —dressed lumber, 4" x 8" x 8'
1 pc. —dressed lumber, 1" x 8" x 12'
1 pc. —dressed lumber, 1" x 4" x 12'
3 pcs. —pipe, 60" long, 1" outside diameter
18 —iron straps, ⅛" x 1⅜" x 4'0"
6 —washers, 1⅛" size
4 —sprockets, 5" diameter, 1" bore
96 in. —chain for sprockets
2 pcs. —sheet iron, ⅛" x 5⅞" x 4'6"

Discharge Hopper

2 sheets—3' x 8', 20 gauge galvanized metal
100 —stove bolt and nuts, 3/16" x ½"

Base of Drier

3 pcs. —dressed lumber, 6" x 6" x 12', for legs of base and horizontal supporting members
4 pcs. —dressed lumber, 2" x 6" x 12', for braces

Miscellaneous Items

200 —wood screws, No. 15, 3"
100 —wood screws, No. 10, 1½"
100 —wood screws, No. 8, ¾"
5 lbs. —small nails, for tacking sheet metal to inverted sections
75 —lag screws, ¼" x 4"
1 —blower, similar to Type BC-40 manufactured by ILG Electric Company, 304 Natchez Bldg., New Orleans, Louisiana
1 —speed reducer, similar to D. O. James Type "27-H" Worm Gear Speed Reducer, Size 27H, ratio 108.00 to 1. Sold by F. N. Johnson, Inc., American Bank Bldg., New Orleans, La.
1 —electric motor, 2 H.P., 1750 RPM, for blower
1 —electric motor, ½ H. P., 1750 RPM, for speed reducer
1 —butane tank, 100 gallon size or larger
2 —gas burners, 200,000 BTU/hr. ea. Plans available from La. Agr. Exp. Sta.
1 —old 55 gal. oil drum, open at ends. Use as duct for heated air at inlet to blower. Do not attach to blower.
2 —thermometers, 20-220°F. range
2 —belt and bucket elevators. Plans available from Michigan State College, Agr. Exp. Sta., East Lansing, Michigan. Circular Bulletin 193, "The Michigan Vertical Cup Type Elevator for Small Grain."

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* This list gives material of standard sizes. In some cases, it will have to be dressed down to conform to the sizes called for in the blueprints.

ACKNOWLEDGMENTS

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COST AND UTILIZATION OF POWER AND EQUIPMENT ON FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA OF LOUISIANA

By

FRANK D. BARLOW, JR., AND LEO J. FENSKE

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TABLE OF CONTENTS

INTRODUCTION 3
  Sampling Procedure 5
  Organization of Farms Surveyed 5
COST AND UTILIZATION OF TRACTOR POWER 9
  Relationship of Size to Cost of Operation 9
  Relationship of Wheel Type to Cost of Operation 10
  Relationship of Days Used Annually to Cost of Operation 11
  Information on Tractors, Tires, and Fuel Consumption 14
  Utilization of Tractors 17
COST AND UTILIZATION OF ANIMAL POWER 21
  Cost of Keeping Workstock in Relation to Size of Farm 22
  Cost of Keeping Workstock in Relation to Number of Days Worked Annually 24
  Utilization of Workstock 24
COST AND UTILIZATION OF COMPLEMENTARY TRACTOR AND WORKSTOCK EQUIPMENT 26
  Cost and Utilization of Equipment 26
  Cost and Utilization of Combines 29
  Cost and Utilization of Hay Balers 31
RATES OF PERFORMANCE WITH TRACTORS AND WORKSTOCK 33
  Accomplishments with Tractor Power 33
  Accomplishments with Workstock Power 34
MAN LABOR AND POWER REQUIREMENTS IN CROP PRODUCTION UNDER MECHANIZED AND NON-MECHANIZED METHODS 35
  Distribution of Man Labor 35
  Distribution of Tractor Requirements 36
  Distribution of Workstock Requirements 38
PROBLEM OF REDUCING POWER AND EQUIPMENT COSTS 38
  Things Farmers May Do to Reduce Power and Equipment Costs 40
SUMMARY 42

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COST AND UTILIZATION OF POWER AND EQUIPMENT ON FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA OF LOUISIANA

FRANK D. BARLOW, JR., AND LEO J. FENSKE[1]

INTRODUCTION

The South has lagged behind the Corn Belt and other areas of the United States in the rate at which tractor power has displaced horse and mule power. The main reason for this is that the production of intensive labor crops like cotton, tobacco, peanuts, and sweet potatoes does not lend itself readily to complete mechanization. In addition the high ratio of farm people to physical resources has been a retarding factor. In recent years, however, an increase in non-farm employment opportunities at attractive wages has resulted in higher wages for labor on farms and advancements in the mechanization of nearly all farm operations. The government control programs that reduced or curtailed acreages of such cash crops as cotton, tobacco, and peanuts, has stimulated greater diversification throughout the southern region and encouraged the trend toward more extensive farming systems and crops that were readily adaptable to mechanized methods.

The first tractors were used in the delta about 1915, but numbers did not increase very rapidly until in the late 1920's when the general-purpose-type tractor was developed. The introduction of rubber tires on tractors, and the all-round improvement in both tractors and tractor equipment made tractors more versatile as a source of power. The trend toward farm mechanization has been very rapid during the war period, as is evidenced by the increase in tractor numbers from 1940 to 1944 (Table 1). The general acceptance of mechanized methods in recent years and the anticipated improvement and development of new mechanical techniques during the next few years, suggest the need for

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[1] Louisiana Agricultural Experiment Station and Bureau of Agricultural Economics, respectively.

FIGURE 1.—Location of the area.

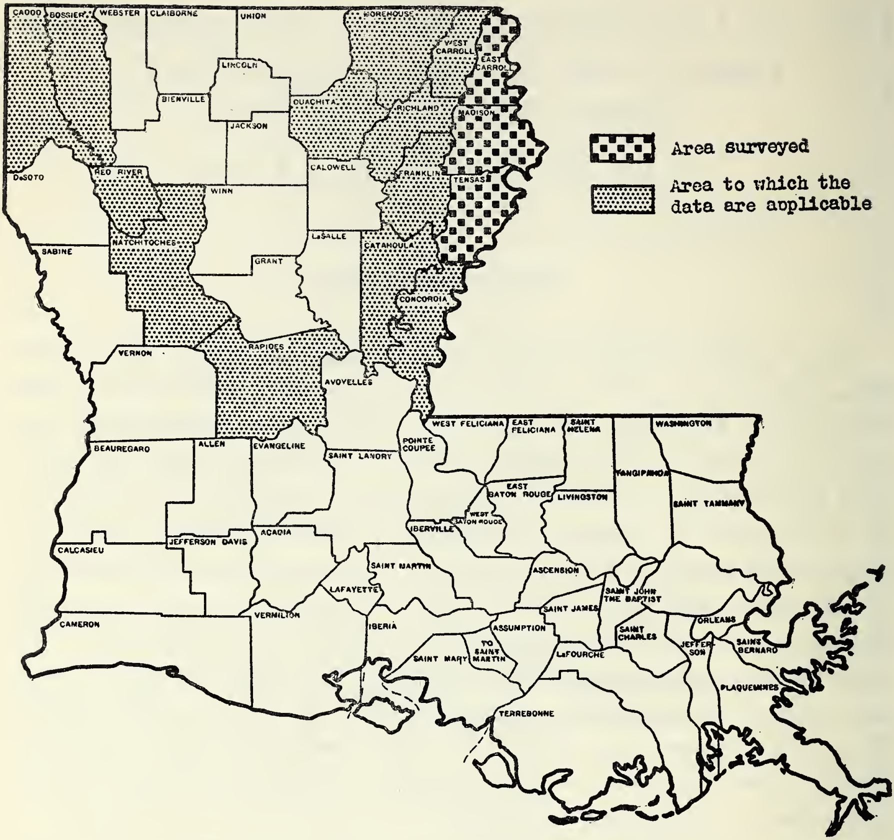

TABLE 1. NUMBER OF TRACTORS ON FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1930-44[1]

Parish	*1930*	*1940*	*1942*	*1944*
Catahoula	55	112	148	181
Concordia	47	181	350	379
East Carroll	65	176	352	355
Franklin	54	247	600	658
Madison	67	234	265	318
Morehouse	44	122	321	325
Ouachita	58	109	250	295
Richland	39	156	300	342
Tensas	108	221	525	534
West Carroll	14	153	375	380
Total	551	1711	3486	3767

[1] Source: U.S. Census. Data for 1942 and 1944 were compiled from AAA farm plans and rationing certificates.

specific information on the cost and utilization of alternative power systems.

A study of farm power and equipment in relation to the organization of farms as it affects profitable crop combinations was made in the Mississippi River Delta Cotton Area of Louisiana in the spring of 1945. This bulletin presents the results obtained that relate to the cost and utilization of power and equipment on delta farms. The subject matter is organized around the following main topics: (1) cost and utilization of tractor power, (2) cost and utilization of animal power, (3) cost and utilization of complementary tractor and workstock equipment, (4) rates of performing farm operations with mechanical and animal power systems, (5) a comparison of man labor and power utilization in crop production with mechanical and animal power, and (6) the problem of reducing power and equipment costs.

The farm mechanization survey was conducted in East Carroll, Madison, and Tensas Parishes, which are within the boundaries of the type-of-farming area commonly known as the Mississippi River Delta Cotton Area. It is believed that the data obtained from this survey are reasonably applicable throughout the other parishes of this area and also to the Red River Delta Cotton Area in the northwestern part of the state. The area surveyed and the area for which the results are partially applicable are outlined in Figure 1.

Sampling Procedure

The delta cotton areas have long been characterized by the plantation system and a relatively large number of small independent family-operated farms. As a rule the large plantations are concentrated along the river or bayou fronts on the most desirable delta soils. Small farms are interspersed among the plantations but tend to be concentrated more in the back lands and new ground areas.

In order to obtain a representative sample that was statistically reliable for the principal farming systems prevailing in the area, it was necessary to stratify the farms as to size. Four groups of farms were selected as follows: (1) Small farms with less than 50 acres in crops, (2) farms with 50-149 acres in crops, (3) farms with 150-299 acres in crops, and (4) farms with 300 acres or more in crops but less than 1,500 acres in crops. As a rule plantation units with more than 1,500 acres in crops are not typical and for this reason were excluded from the survey. Within the four groups 120 farms were selected at random for detailed study.

Organization of Farms Surveyed

The use of land on the farms surveyed is given in Table 2. The smaller farms had the highest proportion of land area in cropland.

Approximately 65 per cent of the total farm acreage on these farms was in cropland, as compared with 47 per cent on farms in the 50-149 acre group. In the two large-size groups about 40 per cent of the total acreage was cropland. Relatively less farm land was idle on the plantations with 300 acres of cropland and over than on farms in the smaller size groups.

TABLE 2. LAND USE ON 120 FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Land Use	*Size of Farm*[1]			
	Less than 50	*50–149*	*150–299*	*300 and over*
Average per farm:	*acres*	*acres*	*acres*	*acres*
Tilled cropland	33.1	91.9	222.9	622.0
Idle cropland	3.6	9.0	26.7	15.9
Total cropland	36.7	100.9	249.6	637.9
Permanent pasture (open)	8.0	21.8	59.9	107.2
Woodland pasture	4.9	36.5	147.9	405.6
Woods and waste	7.4	53.8	167.4	472.1
Total farm land	57.0	213.0	624.8	1,622.8
Number of farms	39	29	27	25

[1] Based on acres in crops.

The average cotton acreage exceeded that of any other crop in all groups, and corn ranked second, except on the farms in the 150-299 acre group, where the acreage planted to oats was greater than the acreage in corn (Table 3). Oats and lespedeza were relatively more important on farms having more than 150 acres in crops. Soybeans for beans were important on farms in the large group. From 20 to 30 per cent of the total cropland tilled on all farms was planted to winter legumes.

Workstock numbers ranged from 2 head per farm on the small farms to an average of 19 head per farm on the large farms of over 300 acres in crops (Table 4). Nearly all workstock were mules.

Milk cows are kept mainly to produce milk for home use, and the average number ranged from 2 head on the small farms to 5 head on the largest farms. The larger farm operators kept substantial numbers of beef cattle, as is evidenced by an average of 138 per farm on the farms containing 300 or more acres in crops. Brood sow numbers averaged about 1 per farm for the two smaller groups, 1.6 per farm for the third group, and 6.4 per farm in the large group of 300 acres and over.

In the group of farms with less than 50 acres in crops, 22 farms were operated entirely with mules and 17 recently had shifted to tractors as

TABLE 3. CROP ORGANIZATION ON 120 FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Crop Organization	*Size of Farm*[1]							
	Less than 50		*50–149*		*150–299*		*300 and over*	
Average per farm:	*acres*	*per cent*	*acres*	*per cent*	*acres*	*per cent*	*acres*	*per cent*
Cotton	13.0	39.3	31.2	34.0	88.8	39.8	235.7	37.9
Corn	12.9	39.0	31.1	33.8	41.7	18.7	146.6	23.6
Oats	2.8	8.4	15.3	16.7	59.2	26.6	142.5	22.9
Soybeans for beans	0.6	1.8	5.7	6.2	15.6	7.0	36.6	5.9
Soybeans for hay	....	....	0.2	0.2	1.3	0.6	3.6	0.6
Lespedeza	2.5	7.6	14.1	15.3	39.7	17.8	109.5	17.6
Alfalfa	0.5	1.5	1.3	1.4	4.3	1.9	6.7	1.1
Singletary peas for seed	1.0	3.0	3.0	3.3	2.7	1.2	17.8	2.8
Other crops	1.7	5.1	10.6	11.5	16.5	7.4	42.8	6.9
Garden	0.6	1.8	0.2	0.2	0.1	0.0	0.2	0.0
Adjustment for multiple use[2]	2.5	7.5	20.8	22.6	47.0	21.0	120.0	19.3
Total cropland tilled	33.1	100.0	91.9	100.0	222.9	100.0	622.0	100.0
Winter legumes turned under	9.5	28.7	18.0	91.6	71.3	32.0	135.5	21.8
Soybeans interplanted	6.0	18.1	16.3	17.7	13.2	5.9	62.6	10.1
Number of farms	39	..	29	..	25	..	25	..

---

[1] Based on acres in crops.

[2] In making the adjustment for multiple use of land by crops, the first use in the crop year is considered to be the primary use.

TABLE 4. LIVESTOCK ORGANIZATION ON 120 FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, JANUARY 1, 1945

Livestock Organization	*Size of Farm*[1]			
	Less than 50	*50–149*	*150–299*	*300 and over*
Average per farm:	*number*	*number*	*number*	*number*
Mules	1.9	2.6	7.0	18.3
Horses	0.1	0.4	0.6	0.6
Total workstock	2.0	3.0	7.6	18.9
Other horses	0.2	0.4	1.0	2.4
Milk cows	2.3	3.2	3.1	4.5
All other cattle	4.1	19.4	30.6	138.1
Brood sows	0.9	1.1	1.6	6.4
Number of farms	39	29	27	25

---

[1] Based on acres in crops.

the main source of power. There were slight variations in crop and livestock organization on these farms, as is indicated in Tables 5 and 6. The

TABLE 5. CROP ORGANIZATION ON 39 SMALL FARMS IN THE MISSISSIPPI RIVER DELTA COTTON AREA, CLASSIFIED BY TYPE OF POWER SYSTEM, 1944[1]

Crop Organization	*All Farms*	*Mule Farms*	*Tractor Farms*
Average per farm:	*acres*	*acres*	*acres*
Cotton	13.0	13.0	13.0
Corn	12.9	11.0	15.0
Oats	2.8	2.0	3.9
Soybeans for beans	0.6	0.6	1.4
Soybeans for hay	....	....	....
Lespedeza	2.5	2.2	2.9
Alfalfa	0.5	0.2	0.7
Singletary peas for seed	1.0	0.5	1.7
Other crops	1.7	2.6	0.5
Garden	0.6	0.4	0.8
Adjustment for multiple use[2]	2.5	2.5	3.1
Total cropland tilled	33.1	30.0	36.8
Winter legumes turned under	9.5	6.9	12.8
Soybeans interplanted	6.0	5.1	7.2
Number of farms	39	22	17

[1] Less than 50 acres in crops.

[2] In making the adjustment for multiple use of land by crops, the first use in the crop year is considered to be the primary use.

TABLE 6. LIVESTOCK ORGANIZATION ON 39 SMALL FARMS IN THE MISSISSIPPI RIVER COTTON AREA, CLASSIFIED BY TYPE OF POWER SYSTEM, 1944[1]

Livestock Organization	*All Farms*	*Mule Farms*	*Tractor Farms*
Average per farm:	*number*	*number*	*number*
Mules	1.9	2.2	1.4
Horses	0.1	0.2	0.0
Total workstock	2.0	2.4	1.4
Other horses	0.2	0.3	0.1
Milk cows	2.3	2.1	2.5
All other cattle	4.1	3.5	4.8
Brood sows	0.9	1.0	0.8
Number of farms	39	22	17

[1] Less than 50 acres in crops.

small tractor farms were slightly larger than those operated exclusively with mules. Both groups averaged 13 acres of cotton per farm. The tractor farms averaged 15 acres of corn as compared with 11 acres on the mule farms. Other crops were relatively unimportant in comparison with cotton and corn on small farms. The average acreage of winter legumes planted on small tractor farms was nearly double that on those operated with mules. The main differences in livestock numbers on these farms were in workstock numbers. The tractor farms averaged 1.4 head per farm as compared with 2.4 head per farm on the mule-powered farms. Cattle numbers averaged slightly higher on the tractor farms than on the mule farms. Each farm kept about 1 brood sow for producing home consumed pork.

COST AND UTILIZATION OF TRACTOR POWER

Data presented on the cost and utilization of tractor power are based on detailed records for 179 tractors of various sizes and wheel types that were found on the 120 farms included in the farm mechanization study. For purposes of analysis the tractors were divided into three size groups: small tractors, of less than 17 drawbar horsepower; medium, from 17 to 26.9 horsepower; and large, of 27 horsepower and over. The official drawbar horsepower rating as determined by the Agricultural Experiment Station of the University of Nebraska was the basis used in determining the drawbar horsepower of the various tractors.[2]

The cost of tractor operation varies widely and is dependent upon several factors. The principal factors, which are independent of the manner in which tractors are handled (or the care that is taken of them by the operator), are size, wheel type, and the amount of annual use. There are other factors that are more or less within the control of the farm operator and depend upon the care taken in actual operations and the adequacy of servicing and maintenance.

The costs presented are averages and should be interpreted as such. Considerable variations are found from farm to farm, as costs are above average on some farms and below average on others. In using these data care in interpretation should be exercised in light of individual considerations that may vary from farm to farm.

Relationship of Size to Cost of Operation

The size of tractor is a very important factor determining the absolute cost of tractor operation per day or per hour. The average cost of operating all tractors, excluding the wages of the driver, was $5.58 per 10-hour day, or 56 cents an hour, in 1944 (Table 7). The cost of operation ranged from $4.85 a day for small tractors to $6.09 a day for large tractors. Cash expenses for fuel, repairs, and service labor account for approximately 64 per cent of the total cost of operation, and overhead costs for depreciation and interest account for the remaining 36 per cent. Fuel is the principal item of expense in the operation of tractors and depreciation is the second most important cost item.

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[2] See "Summary of Results of the Nebraska Tractor Tests," University of Nebraska, Department of Agricultural Engineering, Jan. 1, 1942, plus supplements. The horsepower ratings used were those determined in Test F giving 100 per cent maximum load.

TABLE 7. AVERAGE COST PER 10-HOUR DAY AND PER HOUR OF OPERATING 179 TRACTORS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*All Tractors*	*Small[1] Tractors*	*Medium[1] Tractors*	*Large[1] Tractors*
Number tractors	179	18	107	54
Average horsepower rating[2]	25.13	15.62	23.58	31.38
Annual use, average days	94.8	93.2	89.3	106.3
Cash expenses:	*dollars*	*dollars*	*dollars*	*dollars*
Fuel (gasoline and fuel oil)	1.85	1.73	1.78	2.03
Grease, oil, and filters	.59	.47	.61	.61
Repairs	.90	.67	.89	.99
Service labor	.26	.23	.26	.27
Total	3.60	3.10	3.54	3.90
Overhead costs:				
Depreciation[3]	1.53	1.38	1.46	1.71
Interest[4]	.45	.37	.45	.48
Total	1.98	1.75	1.91	2.19
Average cost per 10-hour day	5.58	4.85	5.45	6.09
Average cost per hour	0.56	0.49	0.55	0.61

[1] Small tractors, less than 17 drawbar horsepower; medium tractors, 17 to 26.7 horsepower; and large tractors, 27 horsepower and over.

[2] Drawbar horsepower rating, Test F, Nebraska Tractor Tests.

[3] See Table 10 for average purchase price of tractors by size, and Table 11 for average useful life.

[4] Interest figured at 6 per cent on one-half of the average purchase price.

Relationship of Wheel Type to Cost of Operation

Putting rubber tires on tractors has done much to expand the adaptability and increase the usefulness of tractors. This development has facilitated field-to-field transportation and has given greater comfort and convenience to operators. It has long been recognized that fuel consumption is generally less for tractors mounted on rubber and that operating costs are lower, but specific information on the actual difference in cost under practical farm conditions is limited.

Of the 179 tractors for which detailed information was obtained, 114 were mounted on rubber and the remaining 65 tractors were mounted on steel. The 65 tractors mounted on steel were composed of both old-type tractors and new tractors that were manufactured during the war when rubber was scarce. There is a general tendency on the part of farmers who have relatively new steel-rimmed tractors to convert to rubber.

The variation in cost of operation due to type of wheel is presented in Table 8. The average cost of operating all tractors mounted on rubber was $5.48 per 10-hour day, or 55 cents an hour, as compared with $5.80 a day, or 58 cents an hour, for those that were mounted on steel—a margin of 3 cents an hour in favor of rubber-tired tractors.

The average cost ranged from $4.98 per 10-hour day for small tractors on rubber to $5.85 for large tractors on rubber. For tractors on steel the average cost was $4.48 per 10-hour day for small tractors and $6.88 for large tractors. The whole story is not told in this comparison, as the average horsepower rating was greater for those tractors mounted on rubber than for those on steel—25.91 horsepower rating as compared with 23.67. Consequently, the higher horsepower rating of tractors mounted on rubber tends to conceal their lower operating cost. In using these data it is necessary to compare the drawbar horsepower ratings for tractors in each group as they relate to costs of operation.

Cash expenses for all items, fuel, grease, oil, oil filters, repairs, and service labor, were less for tractors mounted on rubber than for those mounted on steel, even though the average drawbar horsepower rating was higher. Overhead costs for depreciation and interest were about the same for each group because tractors mounted on rubber were used more days annually than those on steel—103.6 days as compared with 78.5 days.[8]

Relationship of Days Used Annually to Cost of Operation

The number of days or hours that a tractor is used annually is the most important single factor causing variations in the cost of tractor operation from farm to farm. Every farm operator must give practical consideration to this factor if he is to achieve minimum costs of tractor operation. The fundamental economic principle of spreading overhead costs is involved here. Overhead costs for interest and depreciation prevail whether or not the tractor is used, but operating costs vary almost directly with the amount of use. The overhead costs for interest and depreciation are relatively fixed. Depreciation results from wear and tear due to use and also to obsolesence when not used at all. Therefore if a tractor is used only a few days annually, the overhead costs per day

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[8] See Table 14 on page 18.

TABLE 8. AVERAGE COST PER 10-HOUR DAY AND PER HOUR OF OPERATING 179 TRACTORS, CLASSIFIED BY TYPE OF WHEEL AND SIZE OF TRACTOR, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*All tractors*	*Rubber tires*				*Steel wheels*			
		Small[1]	*Medium*[1]	*Large*[1]	*All Rubber*	*Small*[1]	*Medium*[1]	*Large*[1]	*All Steel*
Number tractors	179	14	58	42	114	4	49	12	65
Average horsepower rating[2]	25.13	16.04	24.13	31.65	25.91	14.14	22.93	29.85	23.67
Annual use, number of days	94.8	95.0	98.0	114.3	103.6	86.8	78.0	78.0	78.5
	dollars	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*
Cash expenses:									
Fuel	1.85	1.72	1.74	1.96	1.82	1.79	1.82	2.30	1.91
Grease	.15	.13	.14	.13	.14	.13	.19	.21	.19
Oil	.35	.26	.34	.37	.34	.22	.37	.33	.35
Oil filters	.09	.09	.08	.10	.09	.11	.10	.11	.10
Repairs	.90	.71	.85	.92	.86	.53	.97	1.14	.97
Service labor	.26	.22	.24	.27	.25	.27	.29	.28	.29
Total	3.60	3.13	3.39	3.75	3.50	3.05	3.74	4.37	3.81
Overhead expenses:									
Depreciation[3]	1.53	1.48	1.53	1.68	1.58	1.07	1.38	1.80	1.44
Interest[4]	.45	.37	.39	.42	.40	.36	.52	.71	.55
Total	1.98	1.85	1.92	2.10	1.98	1.43	1.90	2.51	1.99
Average cost per 10-hour day	5.58	4.98	5.31	5.85	5.48	4.48	5.64	6.88	5.80
Average cost per hour	0.56	0.50	0.53	0.59	0.55	0.45	0.56	0.69	0.58

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[1] Small tractors, of less than 17 drawbar horsepower; medium tractors, 17 to 26.9 horsepower; and large tractors, 27 horsepower and over.

[2] Drawbar horsepower rating, Test F, Nebraska Tractor Tests.

[3] See table 10 for average purchase price of tractors by size, and table 11 for average useful life.

[4] Interest figured at 6 per cent of one-half the average purchase price.

or per hour will be high. If it is fully and effectively used throughout the year, the overhead costs per day will be smaller, depending upon the amount of annual use.

The relationship of the number of 10-hour days used per year and the cost of tractor operation is presented in Table 9. The 179 tractors were sorted and grouped on the basis of the number of 10-hour days used annually. As the number of days of annual use increases, the cost of tractor operation per day and per hour declines, up to a certain point.

TABLE 9. Relationship of the Number of Days used per Year and the Cost of Operation for 179 Tractors in the Mississippi River Delta Cotton Area, 1944

Annual 10-hour Days of Use	*Number Tractors*	*Average Days Used*	*Average Operating Expenses per 10-hour Day*		
			Cash	*Overhead*	*Total*
Group:			*dollars*	*dollars*	*dollars*
Less than 60	32	45	4.25	3.12	7.37
60-89	54	73	3.71	2.11	5.82
90-119	41	103	3.37	1.69	5.06
120-149	36	130	3.20	1.43	4.63
150 and over	16	169	3.44	1.19	4.63
All tractors	179	95	3.60	1.98	5.58

Tractors that were used less than 60 days a year were used on an average of 45 days, and the average cost of operation was $7.37 a day, or 74 cents an hour. Cash costs were higher for tractors that were used less than 60 days a year because certain servicing charges are annual in nature, such as transmission oil changes, hydraulic system changes, etc. The average number of days of use for all tractors was 95, and the average cost per day was $5.58, or 56 cents an hour. For those tractors that were used on an average of 130 days a year, the average cost of operation was $4.63, or 46 cents an hour. Only 16 tractors were used more than 150 days annually, and the average cost of operation was $4.63 a day, the same as for those that were used 130 days annually. Higher operating costs for repairs offset the lower overhead costs for depreciation and interest for these tractors. On the basis of this analysis of 179 tractors, it appears that minimum costs of operation are achieved when tractors are used 120 days a year or more, but little or no reduction in cost of operation is achieved beyond 150 days of annual use. Those tractors that are used more than 150 days annually in the Mississippi River Delta Cotton Area are used for rough work in drainage improvement, land clearing, and logging in addition to regular farm operations. This probably accounts for the higher repair costs that offset the lower overhead costs.

Information on Tractors, Tires, and Fuel Consumption

Purchasing Price of Tractors and Tires—The average purchase price of tractors, by wheel type and size, and the purchase price of tractor tires are presented in Table 10. The average purchase price for all tractors was $1,188, as compared with $1,217 for those mounted on rubber and $1,081 for those mounted on steel. These prices for tractors in the various size groups by wheel types were used in the calculation of overhead costs for depreciation and interest.

TABLE 10. Average Purchase Price of 179 Tractors, Front Tires, and Back Tires, by Wheel Type and Size of Tractor, in the Mississippi River Delta Cotton Area, 1944

Wheel Type and Size of Tractor	*Average Purchase Price*		
	Tractor[1]	*Tractor Tires*	
		Front	*Back*
	dollars	*dollars*	*dollars*
Rubber tires			
Small	944	24	124
Medium	1,148	27	158
Large	1,402	39	176
All rubber	1,217	31	160
Steel wheels			
Small	918	..	...
Medium	1,026	..	...
Large	1,358	..	...
All steel	1,081	..	...
All tractors			
Small	938	..	...
Medium	1,127	..	...
Large	1,392	..	...
All tractors	1,188	..	...

[1] Includes tires when used.

The average purchase price of front and rear tractor tires, by size of tractor, is also given in Table 10. The average purchase price of 2 front tires was reported to be $31 as compared with $160 for the rear tires.

Useful Life of Tractors and Tires—The average age of the 179 tractors studied was 5 years, and farmers estimated that 7 years of useful life remained. The total years of useful life, then, averaged 12 years for all tractors (Table 11). The average useful life of tractors mounted on rubber was 11.4 years as compared with 13 years for those mounted on steel. The present age of steel-rimmed tractors was 6.6 years, on an average, as compared with 4.2 years for those on rubber.

The fact that the total years of useful life was greater for steel-rimmed tractors than for those mounted on rubber may be confusing. Tractors

TABLE 11. ESTIMATED AVERAGE LIFE OF 179 TRACTORS, BY WHEEL TYPE AND SIZE OF TRACTOR IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Wheel Type and Size of Tractor	*Life of Tractor*		
	Present age, years	*Remaining years*	*Total*
Rubber tires			
Small	2.9	7.9	10.8
Medium	4.4	6.7	11.1
Large	4.3	7.6	11.9
All rubber	4.2	7.2	11.4
Steel wheels			
Small	2.8	9.3	12.1
Medium	7.0	6.0	13.0
Large	6.4	7.0	13.4
All steel	6.6	6.4	13.0
All tractors			
Small	2.8	8.2	11.0
Medium	5.5	6.5	12.0
Large	4.8	7.5	12.3
All tractors	5.0	7.0	12.0

on steel were not used as many days annually as those mounted on rubber—78.5 10-hour days as compared with 103.6 days. Therefore, a total of 1,181 10-hour days of use was estimated during the entire life of tractors mounted on rubber as compared with a total of 1,020 10-hour days for those mounted on steel. In other words, the total useful life of tractors mounted on rubber was estimated to be nearly 12 per cent more than for those mounted on steel under practical farm conditions in this area.

The life of tractor tires varies widely depending upon the amount of use that is made of the tractor and especially upon the care that is taken of the tires when the tractor is being used. When tractors are used in rough new ground or rough pasture land, the life of tires is much less than average. In order to extend the total life of tires, proper air pressure must be maintained at all times.

The average total life of front tires is much less than for the larger rear tires. For the 114 tractors reporting rubber tires, the average estimated life of front tires was 2.2 years as compared with 4.8 years for the rear tires (Table 12).

Front tires on large tractors had an average life of 1.8 years as compared with 2.5 years for those on medium tractors and 2.0 years for those on small tractors. Rear tires on large tractors had an average life of 4.8 years as compared with 5.0 on medium-sized tractors and 4.2 years on small tractors. Small tractors in the delta areas are frequently overloaded

TABLE 12. ESTIMATED AVERAGE LIFE OF TRACTOR TIRES ON 114 TRACTORS USED IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Wheel Type and Size of Tractor	*Life of Tires (years)*	
	Front	*Back*
Rubber tires		
Small	2.0	4.2
Medium	2.5	5.0
Large	1.8	4.8
All rubber	2.2	4.8

and are used for numerous odd jobs on terrain that is rough and not conducive to a long life for tires. Medium-sized tractors are used predominantly for field work, while large tractors are used both for field work and to a considerable extent in heavy operations in drainage, land clearing, and logging. Large tractors are also used more days during the year than small or medium-sized tractors.

FUEL, OIL AND GREASE CONSUMPTION—The fuel consumption of tractors is dependent upon several factors, namely the size of tractor, type of wheel, and the type of work that is being done (Table 13). Large-size tractors obviously consume more fuel per day or per hour than medium or small tractors. Tractors on steel require more fuel than those mounted on rubber. The fuel consumption for a given tractor also varies widely depending on the type of work to be done, however. For instance, a medium-sized tractor mounted on rubber usually required about 22.7 gallons of fuel per 10-hour day when used for heavy work (flatbreaking, discing, and bedding), 17.1 gallons when used for light work (planting, cultivating, and mowing), and 14.6 gallons when used for belt work. The average for all types of work is 19.8 gallons per 10-hour day.

Gasoline is generally used for starting purposes only. Unless specified, it is not generally used as the principal fuel. The price differential between gas and tractor fuel discourages the use of gas except where it is specified.

Oil consumption per 10-hour day does not vary greatly for different kinds of work but does vary considerably depending upon the size of tractor (Table 13).

The quantity of grease used per day depends upon the size of tractor and to a lesser extent upon whether the tractor is mounted on steel or rubber. It is difficult to determine the amount of grease used for tractors under practical farm conditions, as the same kind of grease is used for both the tractor and its complementary equipment.

TABLE 13. Average Fuel, Oil, and Grease Consumption per 10-hour Day for Tractors, Classified by Size of Tractor and Type of Wheel, for Heavy and Light Drawbar Work and Belt Work in the Mississippi River Delta Cotton Area, 1944[1]

Size of Tractor, Type of Wheel, and Nature of Work	*Average per 10-hour Day*					
	Combination of Fuels			*Gasoline Exclusively*	*Oil*	*Grease*
	Gasoline	*Fuel Oil*	*Total*			
Small tractors:	*gallons*	*gallons*	*gallons*	*gallons*	*quarts*	*pounds*
Rubber tires						
Heavy work	1.0	17.7	18.7	15.4		
Light work	1.0	12.4	13.4	10.7		
Belt work	1.0	15.0	16.0	8.0		
Average	1.0	14.1	15.1	13.1	0.80	0.25
Steel wheels.						
Heavy work	1.0	22.0	23.0	14.0		
Light work	1.0	16.7	17.7	8.0		
Belt work	1.0	15.0	16.0	....		
Average	1.0	19.3	20.3	11.0	1.60	0.25
Medium tractors						
Rubber tires						
Heavy work	1.2	21.5	22.7	....		
Light work	1.1	16.0	17.1	....		
Belt work	1.0	13.6	14.6	....		
Average	1.1	18.7	19.8	....	1.80	0.36
Steel wheels						
Heavy work	1.3	22.0	23.3	....		
Light work	1.3	17.0	18.3	....		
Belt work	1.2	17.0	18.2	....		
Average	1.3	20.0	21.3	....	2.10	0.42
Large tractors:						
Rubber tires						
Heavy work	1.1	25.0	26.1	....		
Light work	1.1	18.0	19.1	....		
Belt work	1.0	19.5	20.5	....		
Average	1.1	22.1	23.2	....	2.10	0.34
Steel wheels						
Heavy work	1.4	27.0	28.4	....		
Light work	1.5	17.2	18.7	....		
Belt work	1.4	19.0	20.4	....		
Average	1.4	25.2	26.6	....	2.70	0.39

[1] Heavy work includes flatbreaking, discing, bedding, etc., and light work includes planting, cultivating, mowing hay, etc.

Utilization of Tractors

Since the annual amount of use that is made of tractors is one of the chief factors affecting the cost of operation, it is important to appraise the utilization of tractors throughout the year.

For all tractors the average number of 10-hour days used per year was 94.8, or 948 hours (Table 14). Tractors mounted on rubber were used more days during the year than those mounted on steel—103.6 days as compared with 78.5 days. Large tractors mounted on rubber were used more days per year than any other group of tractors.

TABLE 14. Average Number of 10-hour Days Used Annually on and off the Farm for 179 Tractors, by Wheel Type and Size of Tractor in the Mississippi River Delta Cotton Area, 1944

Wheel Type and Size of Tractor	*10-hour Days Used*			
	On farm	*Custom work*	*Total days used*	*No. days of belt work*[1]
Rubber tires				
Small	91.6	3.4	95.0	....
Medium	96.0	2.0	98.0	2.8
Large	111.3	3.0	114.3	4.4
All rubber	101.1	2.5	103.6	3.0
Steel wheels				
Small	84.3	2.5	86.8	5.0
Medium	73.0	5.0	78.0	5.3
Large	74.5	3.5	78.0	2.2
All steel	74.0	4.5	78 5	4.7
All tractors				
Small	89.9	3.3	93.2	1.1
Medium	85.5	3.8	89.3	4.0
Large	103.1	3.2	106.3	3.9
All tractor	91.3	3.5	94.8	3.7

[1] Included in days used on the farm and for custom work.

Custom work affords many farm operators an opportunity to achieve fuller utilization of their tractors and tractor equipment. Very little custom work was performed by full-time farm operators in the delta cotton areas, as indicated in Table 14. For all tractors the average number of days used for custom work was only 3.5 days.

The average number of days that tractors were used for belt work is also included in Table 14. Tractor use for belt work is included in the number of days the tractor was used on the farm and for custom work. All tractors were used on an average of 3.7 days a year for belt work. Tractors mounted on steel were used more for belt work than those on rubber, 4.7 days a year as compared with 3.0 days.

Tractor Use Throughout the Year—Most agricultural production, unlike industry, is seasonal in nature, and it is difficult for farmers to achieve full utilization of the factors of production throughout the year. Because of the variation in seasonal requirements for crop production, power and labor requirements are concentrated into relatively short periods during the growing and harvesting season. During late fall and

TABLE 15. DISTRIBUTION OF DAYS OF TRACTOR USE FOR TRACTORS, CLASSIFIED BY SIZE OF TRACTOR AND TYPE OF WHEEL, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Month	*All tractors*			*Small tractors*			*Medium tractors*			*Large tractors*		
	Total tractors	*Rubber tires*	*Steel wheels*	*Total small*	*Rubber tires*	*Steel wheels*	*Total medium*	*Rubber tires*	*Steel wheels*	*Total large*	*Rubber tires*	*Steel wheels*
	10-hour days											
January	1.9	2.1	1.5	1.7	1.7	1.5	1.7	1.8	1.5	2.5	2.8	1.5
February	3.3	3.5	2.8	2.8	2.7	3.2	2.7	2.6	2.8	4.5	5.0	2.6
March	10.8	11.6	9.3	9.6	9.5	9.7	10.4	11.2	9.3	12.0	12.9	9.0
April	13.4	14.8	10.9	13.2	13.6	12.0	12.9	14.4	11.1	14.5	15.9	9.5
May	12.7	13.8	10.5	15.1	15.2	15.0	12.4	13.7	10.7	12.4	13.6	8.3
June	12.9	14.0	10.8	14.4	14.9	12.5	12.5	13.6	11.2	13.0	14.2	8.5
July	10.0	10.9	8.4	11.4	11.5	11.2	9.2	10.3	7.7	11.1	11.3	10.4
August	8.8	9.9	6.9	8.3	8.7	6.8	7.8	9.0	6.4	11.0	11.4	9.4
September	7.1	7.5	6.3	6.4	6.2	7.3	6.5	7.0	5.8	8.4	8.5	7.9
October	5.9	6.7	4.4	6.3	7.1	3.3	5.1	5.6	4.4	7.4	8.1	5.1
November	5.6	6.1	4.8	3.2	2.9	4.0	5.6	5.9	5.1	6.6	7.4	3.8
December	2.4	2.7	1.9	0.8	1.0	0.3	2.5	2.9	2.0	2.9	3.2	2.0
Total	94.8	103.6	78.5	93.2	95.0	86.8	89.3	98.0	78.0	106.3	114.3	78.0

winter, power requirements in farming are small and as a consequence little use is made of tractors or other farm machinery because little field work is done during this period.

The distribution of tractor use throughout the year is presented by months in Table 15. The variation in tractor use throughout the year by size and wheel type is insignificant. However, tractors mounted on rubber are used more fully during the peak season than those on steel. Tractors on steel have usually been used relatively more in land preparation than in the cultivation of crops, mowing or combining. Rainfall and weather conditions during the growing season tend to limit the number of days that are suitable for field work for mechanical power more than when mules are used.

Because of the limited number of days suitable for field work, farmers should consider the possibilities of using their power unit at night during peak seasons. Only a few farmers were doing night work at the time of this survey, but this does provide a valuable means of meeting power requirements during the peak season of crop production. Also, the fuller utilization of power units tends to reduce the total cost of operation.

TRACTOR USE IN RELATION TO SIZE OF FARM—Tractors are used more fully during the peak season in April, May, and June on large farms with more than 300 acres in crops than on farms of less than 300 acres (Table 16). The total annual use on farms with more than 300 acres in crops was 111.9 days as compared with 91.4 days on farms with 150-299 acres in crops, 74.3 days on farms with 50-149 acres in crops, and only 57.2 days on farms of less than 50 acres in crops.

Tractors on small farms are underutilized during the peak season. On the basis of the usual number of days suitable for field work in the area during April, May, and June, it is estimated that these tractors are utilized at about 50 to 60 per cent of capacity. With this underutilized capacity small farmers have an opportunity to do custom work and obtain fuller utilization of their equipment, thus achieving lower costs of operation. As a rule small farmers are more receptive to custom work than large farmers.

TRACTOR USE FOR DIFFERENT KINDS OF WORK—Farm tractors are used for many types of farm work and with various items of complementary equipment. The distribution of tractor use has been broken down as to the number of hours used annually for combining, baling hay, belt work, use not in conjunction with any equipment on the farm, and with all other complementary equipment—disc, harrow, planter, cultivator, carts, etc. (Table 17).

Tractors were used for custom work to a larger extent on small farms than on large farms. Hours used for combining, baling hay, and belt

TABLE 16. MONTHLY DISTRIBUTION OF DAYS OF TRACTOR USE PER TRACTOR ON FARMS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*All Farms*	*Size of Farm*[1]			
		Less than 50	*50-149*	*150-299*	*300 and over*
Number of farms[2]	95	16	27	27	25
Number of tractors	179	16	31	52	80
Average horsepower rating	25.13	20.34	24.25	25.18	26.08
Tractor cost per day[3]	$5.58	$6.75	$5.77	$5.48	$5.30
Month	*10-hour Days*				
January	1.9	1.4	1.7	1.4	2.3
February	3.3	3.3	3.0	2.1	4.1
March	10.8	8.1	8.4	9.9	12.8
April	13.4	8.8	11.2	13.1	15.3
May	12.7	8.6	10.2	12.3	14.6
June	12.9	8.1	10.8	13.1	14.4
July	10.0	5.4	6.5	10.0	12.3
August	8.8	2.5	6.5	9.1	10.8
September	7.1	2.6	5.0	7.4	8.5
October	5.9	3.3	5.1	5.3	7.1
November	5.6	4.3	4.3	5.5	6.4
December	2.4	0.8	1.6	2.2	3.3
Total	94.8	57.2	74.3	91.4	111.9

[1] Based on acres in crops.

[2] Number reporting tractors.

[3] Average cost of operating tractors per 10-hour day.

work were greater on the larger farms. The average number of tractors per farm is given, and the total hours of tractor use in combination with the complementary equipment is also computed, in Table 17.

COST AND UTILIZATION OF ANIMAL POWER

Workstock are still an important source of power on many delta farms. As a rule workstock are relatively more important on small farms and on large farms that are operated primarily by sharecroppers or share-renters.

In order to appraise the relative economies of mechanical and animal power systems, it was necessary to obtain detailed costs of keeping workstock as a source of power. Therefore, detailed information was obtained on the usual feeding practices, the useful life, and the annual use of workstock. The cost of keeping workstock was relatively high in 1944 primarily because of high feed prices.

The average cost of keeping a mule on all farms included in this

TABLE 17. UTILIZATION OF TRACTORS FOR DIFFERENT KINDS OF WORK, BY SIZE OF FARM, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*Size of Farm*[1]			
	Farms less than 50 acres	*50-149 acres*	*150-299 acres*	*300 acres and over*
Total hours of tractor work	572	743	914	1,119
Total hours of custom work	131	95	26	0
Average for each Tractor:				
Hours used for combining	4	29	43	54
Hours used for baling hay	3	23	26	32
Hours used for belt work	17	64	52	23
Hours tractor used alone[2]	35	12	..	2
Hours tractor used with other complementary equipment[3]	513	639	793	1,008
Average number of tractors on farm	1[4]	1.3	1.9	3.2
Total hours tractors used with other complementary equipment[3]	513	831	1,507	3,256

[1] Based on acres in crops.

[2] Usually custom work.

[3] Excluding tractor use for combining, hay baling, belt work, and use when the tractor only was rented out.

[4] Average for only those farms with tractor, 17 farms.

study was $198.55, excluding a credit for manure (Table 18). No credit was allowed for manure, as it was assumed this item would offset the cost of shelter in most instances. Feed costs accounted for $158.08, or nearly 80 per cent of the total costs.

Cost of Keeping Workstock in Relation to Size of Farm

The cost of keeping workstock was less on small farms than on large farms—$183.28 per head on all farms with less than 50 acres in crops as compared with $209.66 on farms with 150-299 acres in crops and $223.00 on farms with over 300 acres in crops. Better workstock are usually maintained on the large plantation units than on the small farms in the delta areas.

If the average annual cost of keeping workstock is divided by the average number of hours workstock were used during the year, the average cost per hour of use is obtained. On the farms included in this study the average cost per hour was 31 cents. The average cost per hour was lowest on the group of small farms and on the large farms with more than 300 acres in crops. Average costs were higher on medium-sized farms from 50 to 149 and 150-299 acres in crops.

TABLE 18. AVERAGE COST OF KEEPING WORKSTOCK PER HEAD AND COST PER HOUR OF USE ON FARMS, CLASSIFIED BY SIZE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Item	Unit	*Average all head*		*Size of farm (acres in crops)*							
				Less than 50		*50–149*		*150–299*		*300 and over*	
		Amount	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*
Feed costs:											
Corn	bu.	45.0	$ 65.25	60.3	$ 87.44	47.9	$ 69.49	28.3	$ 41.04	36.1	$ 52.35
Oats	bu.	38.5	38.50	5.1	5.10	21.0	21.00	73.9	73.90	72.9	72.90
Legume hay	ton	2.0	46.00	1.9	43.70	1.9	43.70	2.1	48.30	1.9	43.70
Non-legume hay	ton	0.1	1.80	....	.....	0.2	3.60	0.1	1.80	0.1	1.80
Salt	lbs.	40.8	.53	35.0	.46	44.0	.57	43.8	.57	43.6	.57
Pasture	mo.	6.0	6.00	6.7	6.70	6.1	6.10	6.0	6.00	5.0	5.00
Total		....	$158.08	....	$143.40	....	$144.46	....	$171.60	....	$176.32
Other costs:											
Depreciation[2]		....	$ 15.07	....	$ 11.80	....	$ 13.86	....	$ 15.67	....	$ 21.96
Interest[3]		....	5.31	....	4.53	....	4.78	....	5.29	....	7.22
Chore labor	hrs.	66	13.20	85	17.00	72	14.40	45	9.00	50	10.00
Harness		....	5.15	....	4.84	....	5.04	....	5.92	....	5.67
Miscellaneous		....	1.74	....	1.71	....	1.43	....	2.18	....	1.83
Total		....	$ 40.47	....	$ 39.88	....	$ 39.51	....	$ 38.06	....	$ 46.68
Total all costs[4]		....	$198.55	....	$183.28	....	$183.97	....	$209.66	....	$223.00
Average hours worked annually		640	......	663	......	546	......	593	......	766	......
Average cost per hour worked		....	$ 0.31	....	$ 0.28	....	$ 0.34	....	$ 0.35	....	$ 0.29

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[1] Prices used: corn, $1.45 per bushel; oats, $1.00 per bushel; legume hay, $23 per ton; non-legume hay, $18 per ton; salt, $1.30 per cwt.; pasture, $1 per month; chore labor, $0.20 per hour.

[2] Average estimated value of workstock when purchased, $177. Estimated years of useful life, 11.75.

[3] Interest calculated at 6 per cent of one-half the estimated value of workstock.

[4] The cost of shelter is not included. It is assumed that the value of manure is sufficient compensation for shelter.

Cost of Keeping Workstock in Relation to Number of Days Worked Annually

There is considerable variation in the cost of keeping workstock, depending upon the amount of annual use. As compared with the average cost of $198.55 for keeping workstock on all farms, the annual cost per head was only $162.97 when workstock were used less than 30 days or 300 hours a year, $178.75 when used from 30 to 59 days, $206.52 when used from 60 to 89 days, and $225.21 when used more than 90 days a year (Table 19).

If workstock are kept in good working condition and only partially utilized as a source of power, the cost per hour of use is very high—$1.17 per workstock hour for those worked only 139 hours annually. This compares with 44 cents an hour when workstock are used 410 hours annually, 27 cents when used 761 hours and 21 cents when used on an average of 1,055 hours during the year.

Utilization of Workstock

The annual amount of use that is made of workstock directly affects the cost per hour of use. Farm operations have been mechanized rapidly and workstock numbers have not been decreased materially as tractors have been added. Consequently, workstock are underutilized on all groups of farms that have been mechanized.

When workstock are used fully under non-mechanized conditions, they are used on an average more than 90 days a year or approximately 1,055 hours. The cost per workstock hour under these conditions was shown to be about 21 cents. Under conditions prevailing at the time of this survey, workstock were being used on an average of only 640 hours annually at a cost of 31 cents.

It was apparent that most farmers had made little attempt to reduce feed costs when workstock were being used at less than capacity. The principal reason for not reducing feed costs in proportion to the underutilization of workstock was that it was necessary to keep them in strong physical condition if they were to be used at all. Some farmers, however, were making reductions in daily rations, and workstock were being pastured to a greater extent.

Farmers estimated that purchase of one medium-sized tractor would provide sufficient power to replace 6 to 8 head of workstock, depending upon the type of work to be done—6 in light work and 8 for heavy work. However, most farmers have not reduced workstock immediately upon adoption of tractor power, and as a result power costs are higher than they should be.

If farmers are to achieve the economies afforded through the mechan-

TABLE 19. Average Cost of Keeping Workstock per Head and Cost per Hour of Use for Groups of Workstock Classified by Number of Days Worked Annually in the Mississippi River Delta Cotton Area, 1944[1]

Item	*Unit*	*Average all head*		*Size group (10-hour days worked per year)*							
				Less than 30		*30-59*		*60-89*		*90 and over*	
		Amount	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*	*Amount*	*Cost*
Feed Costs:											
Corn	bu.	45.0	$ 65.25	33.9	$ 49.16	42.9	$ 62.21	46.5	$ 67.43	52.3	$ 75.84
Oats	bu.	38.5	38.50	28.1	28.10	28.2	28.20	41.6	41.60	50.9	50.90
Legume hay	ton	2.0	46.00	1.9	43.70	1.7	39.10	2.0	46.00	2.2	50.60
Non-legume hay	ton	0.1	1.80	0.1	1.80	0.2	3.60	0.1	1.80	....	.....
Salt	lbs.	40.8	.53	41.4	.54	35.4	.46	41.6	.54	43.4	.56
Pasture	mo.	6.0	6.00	8.4	8.40	5.9	5.90	6.1	6.10	4.1	4.10
Total		....	$158.08	....	$131.70	....	$139.47	....	$163.47	....	$182.00
Other Costs:											
Depreciation[2]		....	$ 15.07	....	$ 11.77	....	$ 13.63	....	$ 16.86	....	$ 15.80
Interest[3]		....	5.31	....	4.54	....	4.88	....	5.61	....	5.50
Chore labor	hrs.	66	13.20	44	8.80	71	14.20	70	14.00	69	13.80
Harness		....	5.15	....	5.11	....	5.03	....	5.16	....	5.27
Miscellaneous		....	1.74	....	1.05	....	1.54	....	1.42	....	2.84
Total		....	$ 40.47	....	$ 31.27	....	$ 39.28	....	$ 43.05	....	$ 43.21
Total all costs[4]		....	$198.55	....	$162.97	....	$178.75	....	$206.52	....	$225.21
Average hours worked annually		640	......	139	......	410	......	761	......	1055	......
Average cost per hour worked		....	$ 0.31	....	$ 1.17	....	$ 0.44	....	$ 0.27	....	$ 0.21

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[1] Prices used: corn, $1.45 per bushel; oats, $1.00 per bushel; legume hay, $23 per ton; non-legume hay, $18 per ton; salt, $1.30 per cwt.; pasture, $1.00 per month; chore labor, $0.20 per hour.

[2] Average estimated value of workstock when purchased, $177. Estimated years useful life, 11.75.

[3] Interest calculated at 6 per cent of one-half the estimated value of workstock.

[4] The cost of shelter is not included. It is assumed that the value of manure is sufficient compensation for shelter.

ization of farm operations, workstock numbers must be drastically reduced. Economy-conscious operators cooperating in this study of 120 farms have demonstrated that it is feasible to substitute a medium-sized tractor for 6 mules without impairing effectiveness in the performance of farming operations.

COST AND UTILIZATION OF COMPLEMENTARY TRACTOR AND WORKSTOCK EQUIPMENT

The mechanization of farm operations has resulted in greater capital requirements for equipment. In addition to the consideration of power costs, it is necessary to evaluate the cost of operating complementary equipment that is used in conjunction with the power unit. In order to compare the economy of mechanized versus non-mechanized methods of farming, equipment costs deserve careful analysis.

The materials presented in this bulletin on the cost and utilization of complementary tractor equipment are divided into three parts: (1) cost and utilization of tractor and workstock equipment, exclusive of specialized machines such as combines and hay balers, (2) cost and utilization of combines, and (3) cost and utilization of hay balers. All mule equipment is grouped together and analyzed as a unit.

Costs of operating various farm implements vary widely. Individual variations in the cost of repairs and depreciation for different farm implements are related to the amount of use that is made of them, the care in operation, and the general physical features of the terrain. From the practical consideration of farming, however, it may be assumed that certain items of field equipment even though used very little during the year are as important as those that are used frequently throughout the year. In other words, planting equipment that is used only in one operation is just as essential to crop production as a cultivator or disc that is used much more frequently. For this reason, as well as for the sake of simplification, all field machinery costs except for the specialized machines are grouped together.

Cost and Utilization of Equipment[4]

Where mechanical power has been adopted, both tractor and workstock equipment are usually found. In the determination of costs, tractor and workstock equipment have been segregated. As progress is made toward complete mechanization, the relative importance of workstock equipment is expected to decline.

TRACTOR EQUIPMENT[5]—The average investment in tractor equipment

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[4] Exclusive of combines and hay balers, which are handled separately in this section.

[5] See Appendix Table 1 for supplementary information on average purchase price, depreciation, repairs, and interest for individual items of equipment.

TABLE 20. Average Investment in Tractor and Workstock Equipment, Costs per Farm, per Acre, and per Hour of Use on Farms, Classified by Size, in the Mississippi River Delta Cotton Area, 1944

Item	*All farms*		*Less than 50 acres cropland*			*50-149 acres cropland*		*150-299 acres cropland*		*300 acres cropland and over*	
			Mule farms	*Tractor farms*							
	Tractor equipment[1]	*Mule equipment*	*Mule equipment*	*Tractor equipment*[1]	*Mule equipment*	*Tractor equipment*[1]	*Mule equipment*	*Tractor equipment*[1]	*Mule equipment*	*Tractor equipment*[1]	*Mule equipment*
	dollars	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*
Investment:											
Per farm	1,418	739	366	444	172	943	406	1,322	799	2,657	1,772
Per acre cropland	6.29	3.28	11.40	10.42	4.04	9.35	4.02	5.30	3.20	4.17	2.78
Annual equipment cost per farm:											
Repairs	109	35	27	33	10	60	23	104	42	215	63
Depreciation	137	62	25	39	15	84	30	126	69	271	157
Interest	43	22	11	13	5	28	12	40	24	80	53
Total	289	119	63	85	30	172	65	270	135	566	273
Total cost per acre of cropland[2]	1.28	0.53	1.96	2.00	0.70	1.70	0.64	1.08	0.54	0.88	0.43
Total hours of use per farm	1560	4480	2011	513	493	831	1638	1507	4507	3256	14,477
Average cost per hour of use	$ .185	$ .027	$ .031	$ .166	$ .061	$ .207	$ .040	$ .179	$ .030	$ .174	$ .019

[1] Excludes tractors, hay balers, and combines.

[2] For average acreage of cropland by size groups, see Table 3.

per farm, exclusive of combines and hay balers, ranged from $444 on small farms with less than 50 acres in crops to $2,657 on farms with more than 300 acres. The investment in tractor equipment per acre of cropland is less on the larger farms, however, than on small farms—$4.17 an acre on farms with more than 300 acres in crops and $10.42 on farms with less than 50 acres.

Annual equipment costs consist of repairs, depreciation, and interest on investment. The average annual cost of operating tractor-drawn equipment was $289 for all tractor farms (Table 20). The annual cost ranged from $85 on farms with less than 50 acres in crops to $566 on farms with more than 300 acres.

Per acre costs of equipment, however, were less on large farms than on small farms. The annual equipment costs per acre ranged from $0.88 on farms with more than 300 acres in crops to $2.00 on farms with less than 50 acres (Table 20).

If the annual cost of operating farm equipment is divided by the total number of hours that the equipment was used, the average cost per hour of use is obtained. The average cost per hour of use was 18.5 cents for all tractor farms. Farms with 50-149 acres in crops had the highest equipment cost per hour. These farms are usually fully equipped. The cost per hour of use was least on small farms. Usually, only the essential items of equipment for land preparation, planting, and cultivation are found on farms with less than 50 acres in crops and they are more fully utilized than on those farms that are slightly larger and more fully equipped. Fuller utilization of equipment on the larger farms of course results in lower costs of operation per hour of use.

WORKSTOCK EQUIPMENT—Workstock equipment is still found on most all farms, even on those where operations have become highly mechanized. With the shift from non-mechanized to mechanized power systems, however, much of this equipment is only partially used and frequently it is not used at all.

The average investment in mule equipment per farm, by size groups, is given in Table 20. It is difficult to determine values of this equipment on highly mechanized farms, as much of it is obsolete and not used to any great extent. The variation in investment per acre is due both to the influence of the size of farm and to the degree to which farming operations have been mechanized.

Annual costs of operation, as for tractor equipment, consist of annual repairs, depreciation, and interest. Wide variations in the relative importance of depreciation and repairs exist among farms and are usually related to the principal type of power used on the farm, the extent of equipment use, and the care that is taken of the equipment itself.

The average cost per hour of use on all farms was 2.7 cents as compared with 3.1 cents on small farms operated entirely with mules and 1.9 cents on farms with more than 300 acres in crops. The highest cost of operating mule equipment was 6.1 cents an hour, and that was on small farms where mechanical power systems had been adopted.

UTILIZATION OF EQUIPMENT—The use that is made of equipment varies greatly from farm to farm depending primarily upon equipment inventories in relation to acres of cropland operated. The shift from animal to mechanical power systems has proceeded so rapidly in this area that all farms have greater inventories than are required to perform the usual operations. Excessive inventories are generally due to surplus workstock equipment.

The total hours that the complementary tractor and workstock equipment were used on the farms surveyed are included in Table 20. The variations in use due to size of farm and type of power system may be observed.

Cost and Utilization of Combines

The combines presently in use on delta farms are about evenly divided between those with the power take-off and with the auxiliary motor. The annual cost of operating combines per year was greater for those with the auxiliary motor, $232.49 as compared with $171.45 for those with the power take-off. The acreage harvested per machine was greater for combines with the auxiliary motor, 119 acres as compared with 99 (Table 21).

The average cost of operating combines with an auxiliary motor was $1.95 an acre as compared with $1.73 an acre for those with the power take-off (Table 21). The cost of operating combines with an auxiliary motor exceeds that of operating those with the power take-off by 22 cents an acre. This differential is about equal to the operating costs for fuel and oil.

Depreciation is the chief item of cost, amounting to more than one-half of the total. The cost of repairs and upkeep is second in importance and interest on investment is third.

The average age of combines with the power take-off was greater than those with a motor, 4.5 years as compared with 2.7 years (Table 22). The estimated total useful life was about the same for both types of combines. Combines with the auxiliary motor recently have gained popularity and are generally preferred to those with the power take-off, mainly because they are more effective in harvesting crops. The efficiencies gained more

TABLE 21. AVERAGE COST PER YEAR AND PER ACRE OF OPERATING SIXTY-ONE 60-INCH COMBINES, BY TYPE OF POWER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Combines with			
	Power take-off[1]		Auxiliary motor[1]	
	Cost per year	Cost per acre	Cost per year	Cost per acre
	dollars	*dollars*	*dollars*	*dollars*
Repairs and upkeep[2]	49.83	.50	43.39	.36
Depreciation[3]	97.14	.98	130.23	1.09
Interest[4]	24.48	.25	33.60	.28
Operating costs[5]	......	....	25.27	.21
Total[6]	171.45	1.73	232.49	1.95
Acreage harvested per combine	99		119	

[1] Thirty-one combines with power take-off; thirty combines with auxiliary motor.

[2] Average of farmers' estimates of the annual repair and upkeep costs.

[3] The average purchase price for combines with the power take-off was $816 and the estimated useful life 8.4 years; the average purchase price for combines with the auxiliary motor was $1,120 and the estimated useful life was 8.6 years.

[4] Interest charged at 6 per cent on one-half of the average purchase price.

[5] Operating cost for auxiliary motor includes the charge for fuel and oil.

[6] Does not include a charge for taxes, shelter, or labor for operating the machine.

TABLE 22. AVERAGE AGE, ESTIMATED YEARS OF USE LEFT, AND THE EXPECTED TOTAL LIFE OF SIXTY-ONE 60-INCH COMBINES, BY TYPE OF POWER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	Combines with	
	Power take-off	Auxiliary motor
	years	*years*
Average age	4.5	2.7
Estimated use left	3.9	5.9
Total useful life	8.4	8.6
Number of combines	31	30

than offset the additional cost of operation, according to the farmers interviewed.

The average acreage of crops harvested per combine is given in Table 23. Oats were by far the most important crop combined in the area. Other important crops that were harvested with a combine are soybeans, Singletary peas, and clover seed in that order.

TABLE 23. AVERAGE ACREAGE OF CROPS HARVESTED PER COMBINE IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Crop	*Combine with*		*Average all combines*
	Power take-off	*Auxiliary motor*	
	acres	*acres*	*acres*
Oats	79	89	84
Soybeans	15	23	19
Singletary peas	4	6	5
Clover	1	1	1
Total	99	119	109

Cost and Utilization of Hay Balers

There are three principal types of hay balers on delta farms: stationary tractor-powered balers, stationary balers with auxiliary motors, and pick-up balers. The pick-up balers in 1944 were operated with three men, but the general preference is for the adoption of one-man pick-up balers.

The annual cost of operating pick-up balers is higher than for the stationary balers, $183.22 as compared with $33.69 for stationary tractor-powered balers and $69.65 for stationary balers with an auxiliary motor (Table 24).

TABLE 24. AVERAGE ANNUAL COST AND COST PER ACRE OF OPERATING HAY BALERS, BY TYPE OF BALER, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Item	*Stationary with*				*Pick-up balers*[1]	
	Tractor power[1]		*Auxiliary motor*[1]			
	Annual cost	*Cost per acre*	*Annual cost*	*Cost per acre*	*Annual cost*	*Cost per acre*
	dollars	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*
Repairs and upkeep[2]	8.00	.08	10.75	.10	28.08	.17
Depreciation[3]	17.68	.18	29.44	.29	104.56	.64
Interest[4]	8.01	.08	14.13	.14	31.68	.19
Operating costs[5]	.....	.....	15.33	.15	18.90	.12
Total[6]	33.69	.34	69.65	.68	183.22	1.12
Acreage per baler	97		102		164	

[1] Five stationary balers operated with tractor power; twenty-one stationary balers with an auxiliary motor; and twelve pick-up balers.

[2] Average of farmers' estimates of the annual repair and upkeep costs.

[3] The average purchase price for stationary balers without auxiliary motors was $267 and the estimated useful life 15 years; the average purchase price for stationary balers with an auxiliary motor was $471 and the estimated useful life was 16 years; and the average purchase price for pick-up balers was $1,056 and the estimated useful life was 10.1 years.

[4] Interest charged at 6 per cent on one-half of the average purchase price.

[5] Operating costs for auxiliary motor includes the charge for fuel and oil.

[6] Does not include a charge for taxes, shelter, or labor for operating the machine.

Acreage harvested per baler is considerably larger for pick-up balers. Per-acre cost of operating pick-up balers is also higher, $1.12 as compared with $0.34 for stationary tractor-powered balers and $0.68 for balers with an auxiliary motor. The increased efficiency of pick-up balers, due primarily to reductions in labor required for the haying operation, more than offsets the higher machinery cost per acre, however.

The trend has been toward the adoption of larger and more efficient balers. This is evidenced by the average age of balers now in use (Table 25). The average age of stationary tractor-powered balers was 9.2 years, stationary balers with an auxiliary motor 4.6 years, and pick-up balers 1.7 years. The estimated life of pick-up balers is only about two-thirds that of stationary balers and accounts for higher annual depreciation costs.

TABLE 25. Average Age, Estimated Years of Use Left, and Expected Total Life of 38 Hay Balers, by Type of Baler, in the Mississippi River Delta Cotton Area, 1944

Item	*Type of Baler* *Stationary* *Tractor power*	 *Auxiliary motor*	 *Pick-up balers*
	years	*years*	*years*
Average age	9.2	4.6	1.7
Estimated use left	5.9	11.4	8.4
Total useful life	15.1	16.0	10.1
Number of balers	5	21	12

Lespedeza was the principal hay crop in the delta, followed by alfalfa, Johnson grass, and other miscellaneous native grasses (Table 26). The

TABLE 26. Average Acreage of Hay Crops Harvested, by Crop and Type of Baler, in the Mississippi River Delta Cotton Area, 1944

Crop	*Stationary Balers* *Tractor power*	 *Auxiliary motor*	*Pick-up balers*	*Average all balers*
	acres	*acres*	*acres*	*acres*
Lespedeza	88	79	103	88
Alfalfa	4	17	38	23
Johnson grass	0	4	23	10
Other hay	5	2	0	2
Total	97	102	164	123

average acreage harvested per baler was 123 acres, and ranged from 97 acres harvested per baler for stationary tractor-powered balers to 164 acres for pick-up balers.

RATES OF PERFORMANCE WITH TRACTORS AND WORKSTOCK

Increased efficiency in the utilization of labor is one of the most important aspects of the substitution of mechanical for animal power. Detailed information was obtained on practices and usual operations employed in producing the major crops in the area, including the usual rates of performing each operation. In actual practice rates vary with the size of power unit, size and condition of implement used, nature of the soil, and other factors. Efficiency can be gained by using the proper sized equipment with either tractors or mules.

Accomplishments with Tractor Power

The usual rates of performing the various field operations with tractors are presented in Table 27. Since the size of implement used is almost

TABLE 27. USUAL RATES OF PERFORMING THE VARIOUS OPERATIONS WITH TRACTORS IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Operations	*Size implement*	*Acres per 10-hr. day*	*Hours per acre*	
			Man	*Tractor*
Cutting stalks	2 row	22.2	0.45	0.45
Flatbreaking	2 pan	5.2	1.92	1.92
Flatbreaking	3 pan	7.3	1.37	1.37
Disking	6 feet	17.0	0.59	0.59
Harrowing(section)	8-12 feet	26.6	0.38	0.38
Breaking, middlebuster	2 row	14.8	0.68	0.68
Breaking, middlebuster	4 row	27.3	0.37	0.37
Rebreaking, middlebuster	2 row	15.4	0.65	0.65
Planting	2 row	17.6	0.57	0.57
Planting	4 row	41.7	0.24	0.24
Cultivating, 1st. and 2nd. time	2 row	12.7	0.79	0.79
Cultivating, other times	2 row	18.4	0.54	0.54
Cultivating, 1st. and 2nd. time	4 row	20.8	0.48	0.48
Cultivating, other times	4 row	37.5	0.27	0.27
Seeding oats, grain drill	8-10 feet	22.7	0.44	0.44
Seeding oats, grain drill	12-14 feet	28.2	0.35	0.35
Seeding oats, endgate seeder	......	42.6	0.23	0.23
Fertilizing oats, drill	8-10 feet	23.8	0.42	0.42
Fertilizing oats, endgate seeder	......	52.5	0.38	0.19
Combining oats	60 inch	12.8	1.56	0.78
Combining soybeans	42 inch.	7.7	2.60	1.30
Combining soybeans	60 inch	10.1	1.98	0.99
Mowing hay	7 feet	17.4	0.57	0.57
Raking hay (side delivery)	10 feet	20.8	0.48	0.48
Raking hay (dump)	10 feet	18.0	1.10	0.55

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[1] Rates based on accomplishments of medium-sized tractors. Accomplishments for row crop operations based upon a standard 42-inch row.

directly related to accomplishment, rates were established for equipment of different sizes. It is also true that size of tractor is associated with variation in rates of performance. Large tractors are usually used when the large-sized implements are used and medium or small tractors are used with the smaller sized implements. In addition to the size and condition of implement used and the size of the power unit, other factors such as nature of the soil, and size and shape of the field affect the rates of performing farm jobs. These rates are averages and this should be considered in their interpretation.

The usual rates of performance are presented in terms of the average acreage covered in a 10-hour day. They are also presented in terms of man labor and power requirements per acre for performing each operation.

These data can be used for calculating labor and power requirements for any given crop. The practices and operations, including the number of times over, should be listed in sequence, and the time required for each job in hours per acre applied. An approximation of the requirements per acre will result from this method.

Accomplishments with Workstock Power

The usual rates of performing farm operations with workstock are presented in Table 28. The number of workstock used in the perform-

TABLE 28. Usual Rates of Performing the Various Operations with Workstock in the Mississippi River Delta Cotton Area[1]

Operation	*Number of mules*	*Acres per 10-hr. day*	*Hours per acre*	
			Man	*Mule*
Cutting stalks	2	7.0	1.4	2.8
Flatbreaking	2	1.6	5.9	11.8
Disking	2	5.5	1.8	3.6
Harrowing (section harrow)	2	11.6	0.9	1.8
Harrowing beds	1	6.7	1.5	1.5
Bedding (two furrows)	2	3.0	3.3	6.6
Bedding (two furrows)	1	2.8	3.6	3.6
Bedding (middlebuster)	2	6.0	1.7	3.4
Planting, 1 row	1	7.1	1.4	1.4
Planting, 1 row	2	7.6	1.3	2.6
Planting, 2 rows	2	14.8	0.7	1.4
Cultivating, 1st. and 2nd. time	2	5.6	1.8	3.6
Cultivating, 1st. and 2nd. time	1	3.0	3.3	3.3
Cultivating, other times over	2	6.7	1.5	3.0
Cultivating, other times over	1	3.3	3.0	3.0
Seeding oats, grain drill (8 qt.)	3	12.0	0.8	2.4
Seeding oats, endgate seeder	3	23.6	0.4	1.2
Mowing hay (4.5 ft.)	2	6.3	1.6	3.2
Raking hay (8 ft. dump)	2	14.3	0.7	1.4

[1] Accomplishments for row crop operations based upon a standard 42-inch row.

ance of a particular operation usually varies directly with the size of the implement. In other words, two mules are used with a double-breaking plow and one mule is used with a single-breaking plow. Two mules are required to operate a one-row cultivator and one mule is required with one-half-row cultivators.

In the delta areas one-row equipment or two-mule teams are typical when non-mechanized methods are employed. One-half-row operations are still employed on extremely small operating units and in the new ground areas, however.

The rates of performing farm jobs are presented in terms of the average acreage covered in a 10-hour day. As for tractor power, they are also given in terms of man labor and workstock requirements per acre for performing each operation. These data may be used for calculating man labor and workstock requirements for any given crop.

MAN LABOR AND POWER REQUIREMENTS IN CROP PRODUCTION UNDER MECHANIZED AND NON-MECHANIZED METHODS

The utilization of labor and power throughout the year is of great importance to the effective utilization of farm resources. Both total requirements and the distribution of these requirements are dependent upon the crop and livestock organization of farming systems, however. Certain crops and kinds of livestock that have extremely high labor requirements during certain seasons of the year make it difficult to obtain an even distribution of labor or power during the year. In order to obtain effective use of labor and power resources it is necessary that the farm organization provide farm work throughout most of the year. The type of power used in crop production is an important factor affecting the distribution and utilization of labor, power, and equipment on delta farms.

Distribution of Man Labor

The distribution of man labor in crop production is important in determining the amount of labor that is necessary to operate the farm. Both the total labor requirements and the distribution of labor are related to and are somewhat dependent upon the power system employed by farmers.

Mechanized Methods—Many farms in the area are completely mechanized with the exception of cotton and corn harvesting. The distribution of man labor when production is mechanized has been summarized for the more important crops in Table 29. When harvesting operations for cotton and corn are mechanized, further downward adjustments in

TABLE 29. USUAL DISTRIBUTION OF MAN LABOR REQUIRED IN CROP PRODUCTION, PER ACRE, UNDER MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	*Crop*								
	Cotton[2]	*Corn*[3]	*Oats*	*Soybeans for beans*	*Lespedeza*[4]	*Soybeans for hay*[4]	*Alfalfa*		*Winter legumes*
							Stationary baler	*Pick-up baler*	
	Hours of Man Labor								
January	4.1	.1	...	...	...	...	...	...	...
February	.1	.2	.2	.2	.4	...	...	...	...
March	.6	1.4	.2	1.2	.6	1.0	...	...	...
April	2.3	3.5	...	1.7	...	1.0	4.1	2.3	...
May	14.4	4.4	1.0	1.2	.3	1.0	9.5	5.5	...
June	14.1	1.8	1.6	.5	.3	.5	9.5	5.5	...
July	7.2	.2	.2	.1	2.1	...	4.1	2.3	...
August	9.1	...	.9	...	4.3	5.0	.8	.8	...
September	31.5	.4	1.7	.1	.7	3.0	1.6	1.6	.7
October	31.6	2.4	.56	1.4	...	1.0	2.0	2.0	.8
November	26.5	4.1	.04	1.2	...	...	...	...	1.2
December	9.2	1.2	...	...	.1	...	...	...	.6
Total per acre	150.7	19.7	6.4	7.7	8.7	12.5	31.6	20.0	3.3

[1] Crop yields are as follows: cotton, 578 lbs. of lint; corn, 26.9 bushels; oats, 40.2 bushels; soybeans for beans, 19.1 bushels; lespedeza, 1 ton; soybeans for hay, 1.5 ton; alfalfa, 3.9 tons.

[2] Hand labor for hoeing and picking.

[3] Hand harvesting.

[4] Baled with tractor and stationary baler.

total labor requirements, as well as more even distribution, are anticipated. At the present stage of mechanization serious labor peaks are encountered during the harvesting season. The reduction in labor required during the growing season means that less labor is needed then, than before farming was mechanized, but the harvesting peak is relatively more severe.

NON-MECHANIZED METHODS—Although most commercial farms have shifted to mechanical power systems, many farms are yet non-mechanized. Total labor required as well as the distribution of labor requirements throughout the year under non-mechanized methods are presented for principal crops in Table 30. Labor requirements are larger where operations are non-mechanized and two peak periods occur in crop production—the growing season and the harvesting season. Since most non-mechanized farms must keep sufficient labor on the farm during the growing season to produce the crops, the peak requirements during the harvesting season are not so severe as on mechanized farms.

Distribution of Tractor Requirements

In order to appraise the utilization and adequacy of power on an individual farm, it is necessary to have data on the total power required

TABLE 30. USUAL DISTRIBUTION OF MAN LABOR REQUIRED IN CROP PRODUCTION, PER ACRE, UNDER NON-MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	*Crop*						
	Cotton	*Corn*	*Oats*	*Lespedeza*[2]	*Soybeans for hay*[2]	*Alfalfa*[2]	*Winter legumes*
	Hours of man labor						
January	.1	.5	....	....	....	....	....
February	.6	1.6	.03	.2	....	....	....
March	4.6	5.3	.27	.8	2.7	....	....
April	5.6	6.4	....	....	1.9	....	....
May	17.5	7.3	1.0	.4	2.3	7.8	....
June	20.3	2.5	2.4	.5	1.5	7.6	....
July	6.7	.6	....	2.7	....	6.7	....
August	12.3	....	1.9	5.6	5.1	3.4	....
September	34.1	....	4.1	.9	2.9	7.1	.7
October	34.1	2.0	2.3	....	.8	1.1	1.3
November	27.9	5.4	.2	....	....	....	1.3
December	5.3	1.2	....	....	....	....	.7
Total	169.1	32.8	12.2	11.1	17.2	33.7	4.0

[1] Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

[2] Hay handled loose.

TABLE 31. USUAL DISTRIBUTION OF TRACTOR POWER REQUIRED IN CROP PRODUCTION, PER ACRE, IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	*Crop*								
	Cotton	*Corn*	*Oats*	*Lespedeza*	*Soybeans for beans*	*Soybeans for hay*	*Alfalfa*		*Winter legumes*
							Stationary baler	*Pick-up baler*	
	Hours of tractor work								
January	...	.1	...	...	...	...	...	...	...
February	.1	.2	.1	...	.2	...	...	...	...
March	.6	1.4	.1	...	1.2	1.0	...	...	...
April	2.3	1.6	...	...	1.7	1.0	1.3	.9	...
May	2.4	1.2	.3	.3	1.2	1.0	3.1	2.3	...
June	2.1	.5	.5	.3	.5	.5	3.0	2.2	...
July	1.2	.3	.2	.7	.1	...	1.3	.9	...
August	...	...	.9	1.3	...	1.0	.8	.8	...
September	...	...	1.7	.2	.05	.5	1.3	1.3	...
October	...	...	.56	...	.5	.2	1.3	1.3	.4
November	...	...	.04	...	.4	...	...	...	.6
December	...	...	...	...	.05	...	...	...	.3
Total	8.7	5.3	4.4	2.8	5.9	5.2	12.1	9.7	1.3

[1] Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

as well as the distribution of these requirements throughout the year. The data on tractor hour requirements and distribution of these requirements are presented in Table 31. From these data it is possible to determine the maximum acreage a given power unit will handle under normal weather and working conditions.

Distribution of Workstock Requirements

Just as in the case of tractor power, total mule work required and the distribution of mule work during the year determine the maximum acreage that a given number of mules can handle. Mule power requirements and the distribution of these requirements are presented in Table 32. Peak requirements occur during the planting and growing season and last for about 3 months. Requirements are relatively small during the rest of the year.

PROBLEM OF REDUCING POWER AND EQUIPMENT COSTS

The delta cotton areas are in the midst of shifting from animal to mechanical power systems. Farmers seldom make the shift to complete mechanization at one time. In other words, mechanization usually progresses by stages. Preparation of land is usually the first operation that is mechanized. The extent to which various operations have been mechanized is presented in Table 33. On the farms surveyed more than 80 per cent of all land preparation in 1944 was done with mechanical power. About one-half of the cotton and corn acreage was cultivated with mechanical power. Approximately two-thirds of the soybean crop was cultivated with tractors. However, no adjustment was made for the abandonment of this crop. Abandonment runs high in the soybean enterprise as the crop is usually planted on back land or weed infested fields. At the time of this survey no mechanical cotton harvesting was practiced. Corn pickers were used only on an experimental basis. Practically all oats and soybeans were harvested with combines pulled by tractors, however.

Because of this transitory condition resulting from the shift from animal to mechanical power systems, high power and equipment costs are to be expected. Adjustments are being made gradually which will tend to reduce these costs of farming. The indivisibility of the farmer's resources will continue in agriculture and will doubtless retard the attainment of minimum power and equipment costs.

Farmers are not doing a good job of protecting their equipment from the natural forces of weather. The degree to which the farmers included in this survey were attempting to provide shelter for their machinery, when it was not in use, is summarized in Table 34.

Nearly three-fourths of all farmers reporting tractors were making an effort to provide shelter for them. Less than half of the tractors on farms under 50 acres were housed when not in use.

TABLE 32. USUAL DISTRIBUTION OF HOURS OF MULE WORK REQUIRED PER ACRE IN CROP PRODUCTION UNDER NON-MECHANIZED METHODS OF FARMING IN THE MISSISSIPPI RIVER DELTA COTTON AREA[1]

Month	*Crop*							
	Cotton	*Corn*	*Oats*	*Lespedeza*	*Soybeans for hay*	*Alfalfa*	*Other crops*	*Winter legumes*
	Hours of mule work							
January	.2	1.1	....	....	....	....	....	....
February	1.2	3.2	.1	....	.8	....	....	....
March	9.2	10.0	.8	....	4.2	....	2.0	....
April	11.2	8.5	.5	....	2.0	....	4.0	....
May	11.0	7.6	1.1	.7	3.0	5.0	4.0	....
June	10.6	2.6	3.8	1.2	1.0	5.0	4.0	....
July	7.4	1.3	8.5	2.8	....	5.0	3.0	....
August	.6	....	5.0	5.8	5.0	2.5	3.0	....
September	2.2	....	.5	.9	3.0	5.0	2.0	1.0
October	2.2	1.4	....	....	1.0	.5	2.0	2.0
November	1.8	4.3	....	....	....	....	....	2.0
December	.6	.8	....	....	....	....	....	1.0
Total	58.2	40.8	20.3	11.4	20.0	23.0	24.0	6.0

[1] Crop yields per acre are as follows: cotton, 578 pounds of lint; corn, 26.9 bushels; oats, 41 bushels; lespedeza, 1 ton; soybeans for hay, 1 ton; alfalfa, 3.9 tons.

TABLE 33. EXTENT TO WHICH FARM OPERATIONS WERE MECHANIZED IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944

Operations	*Selected crops*			
	Cotton	*Corn*	*Oats*	*Soybeans for beans*
	Per cent mechanical power used			
Land preparation	85	81	95	83
Cultivation	49	55	..	67[1]
Harvesting	0	4	89[1]	61[1]

[1] No correction was made for abandonment. In the case of soybeans considerable abandonment is common. Some oats are cut for hay on non-mechanized units. Nearly 100 per cent of the oats and soybeans harvested were combined.

Only 55 per cent of the farmers reporting indicated that other farm machinery was kept under shelter when it was not in use. Large farm operators were more likely to provide shelter than small farmers.

An inquiry was made to determine whether a special machinery shed was maintained on the farm. Only 55 per cent reported that special

TABLE 34. DEGREE TO WHICH TRACTORS AND FARM EQUIPMENT WERE BEING HOUSED, BY SIZE OF FARM, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Size of farm[2]	*Was tractor housed when not used?*			*Was other machinery housed when not used?*			*Is there a special machinery shed on farm?*		
	No. reporting	*Per cent*		*No. reporting*	*Per cent*		*No. reporting*	*Per cent*	
		Yes	*No*		*Yes*	*No*		*Yes*	*No*
Less than 50 acres	16	44	56	24	42	58	24	33	67
50-149 acres	22	82	18	23	61	39	24	54	46
150-299 acres	25	76	24	24	50	50	23	52	48
300 acres and over	22	77	23	22	68	32	22	82	22
Average all groups	85	72	28	93	55	45	93	55	45

[1] Based on the practice of farmers reporting.

[2] Based on acres of cropland.

facilities were maintained for the storage of farm machinery. A higher proportion of large farm operators reported special machinery sheds than did the small farmers—82 per cent of farms with more than 300 acres of cropland as compared with only 33 per cent of farms with less than 50 acres.

On the basis of performance, then, slightly over one-half of the farmers reporting in this survey were attempting to protect their machinery from the weather. This of course is only an indication of the extent to which farmers are conscious of the value of proper equipment care. Undoubtedly the length of useful life could be extended, and consequently the cost of depreciation and repairs reduced, if shelter were provided when the equipment was not in use. Sufficient data are not readily available to evaluate the economies achieved through the protection of machinery by providing proper housing. However, many farmers who are not now protecting their machinery from the weather could do so at nominal cost, either through the conversion of old buildings now on the farm or the construction of simple low-cost machinery sheds.

Things Farmers May Do to Reduce Power and Equipment Costs

Many opportunities exist on farms in the delta cotton areas for sizable reductions in the cost of power and equipment. Some of the more important means of effecting economies in the cost of power and equipment are enumerated as follows:

1. When tractors are adopted as the power unit, reduce workstock numbers to the absolute minimum as soon as possible. On small farms with less than 100 crop acres, one tractor is sufficient power, and workstock can be eliminated. In other instances there may be reasons why one team is necessary for the successful operation of the farm.

2. Increased annual use of the power unit and the complementary equipment is the most effective means of reducing the costs of operation.

Where the power unit and equipment are not used to capacity, plan to work for other farms on a custom basis. Custom work affords an opportunity for the small farmer to obtain fuller utilization of the power unit, and at the same time, it provides employment opportunities for the farmer's labor. Even though it may be necessary to hire labor for certain farm work, the skilled tractor operator stands to gain by doing custom work because he is able to obtain fuller utilization of his power and equipment and at the same time earn wages commensurate with his abilities. On a 40-acre farm, the power unit is used less than 50 per cent of capacity. This means that sufficient power and equipment are available to operate at least another 40-acre farm of similar organization.

3. If the possibility of doing custom work is poor, rent or buy additional farm land if it is available. This is a desirable means of expanding the farm business and could achieve better utilization of labor through diversification of crop and livestock enterprises as well as more complete utilization of power and equipment. Farmers should exercise care in buying additional farm land during periods of high prices. If care is not taken, many farmers may find that the mortgage they give in periods of high prices exceeds the long-run normal agricultural value of the land—not to mention the down payment, which currently ranges from 25 to 50 per cent.

4. If custom work does not prove a satisfactory arrangement and renting or buying additional land is impracticable, explore the possibilities of cooperative ownership and use of the power unit. Two or three small farm operators may find it profitable to own a tractor and the equipment together. When the power system is owned cooperatively, extreme care should be exercised to ensure that the crop system can be handled adequately with the given power unit. Because of the difficulty of finding farmers who will work together, cooperative ownership and use of equipment has definite limitations. By and large, cooperative arrangements will work best when father and son, or brothers, own and operate as a single unit.

5. The use of reliable second-hand equipment may make possible lower power and equipment costs. If the use of second-hand equipment is contemplated, extreme care should be exercised in its appraisal and purchase. This opportunity is especially applicable to small farmers with limited resources.

6. Small tractors and small equipment can be operated at lower cost than larger machines. Adapt the power unit to the job. In the delta cotton areas, however, there is danger of buying tractors and equipment that are too small for effective land preparation. Before selecting small equipment, be sure that it is large enough to do the job. In deciding upon the most economical size of power unit, timeliness of performing farm operations and the cost of labor should be considered. As a rule,

one-row tractor units are not practicable in the delta even on small farms.

7. Depreciation and repairs make up a large proportion of the total costs of operating the power unit and equipment. Any extension in useful life through better care results in lower costs of operation. Proper lubrication and timely repairs result in lower total repair costs and hence lower costs of operation per day, per hour, or per acre.

SUMMARY

1. The adoption of tractors for farm power has proceeded rapidly in the Mississippi River Delta Cotton Area since 1940. The number of tractors on farms in the area increased from 551 in 1930 to 1711 by 1940. From 1940 to 1944 the number of tractors more than doubled—from 1711 to 3767.

2. Farms included in the farm mechanization study were stratified by size into four representative groups that were typical of most farming systems in the delta cotton areas of Louisiana. The size groups were as follows: less than 50 acres in crops, 50-149 acres in crops, 150-299 acres in crops, and over 300 acres in crops but less than 1,500 acres.

3. The average cost of operating 179 tractors based on 1944 price-cost relationships amounted to $5.58 per 10-hour day, or 56 cents an hour. Cash expenses for fuel, oil, grease, repairs, and service labor amounted to $3.60, while overhead costs for depreciation and interest accounted for the remaining $1.98 per 10-hour day.

4. The average cost of operating small tractors of less than 17 drawbar horsepower was $4.85 per 10-hour day; medium-sized tractors from 17 to 27 drawbar horsepower, $5.45 per 10-hour day; and large tractors, 27 horsepower and over, $6.09 per 10-hour day.

5. The number of days that a tractor was used annually was an important factor affecting the cost of operation per day or per hour of use. For tractors that were used on an average of 45 days a year the cost of operation per 10-hour day was $7.37. This compares with a cost of $5.58 per 10-hour day for all tractors, which were used 95 days per year, and $4.63 per 10-hour day for those tractors that were used over 120 days a year.

6. The average annual cost of keeping workstock at 1944 prices was $198.55 per head. When workstock were used less than 30 days per year, the annual cost per head was $162.97; 30-59 days per year, $178.75; 60-89 days per year, $206.52; and more than 90 days per year, $225.21.

7. The cost per hour of use is exorbitant when workstock are maintained in working condition and are not fully used as a source of power. The cost per hour of use was $1.17 for workstock that were used less than 30 days per year, $0.44 for those used from 30-59 days, $0.27 for those used 60-89 days, and $0.21 for those used over 90 days per year.

combines and hay balers, averaged 18.5 cents for all farms.

8. The cost per hour of use of all tractor equipment, excluding

9. The cost of operating all mule equipment averaged 2.7 cents per workstock hour on all farms included in the mechanization survey. On small farms where workstock were the only source of power the cost of all workstock equipment was 3.1 cents per workstock hour.

10. The average annual cost of operating combines was $171.45 for those with the power take-off and $232.49 for those with an auxiliary motor. An average of 99 acres was harvested annually by combines with the power take-off at a cost of $1.73 an acre. Combines with an auxiliary motor were used to harvest an average of 119 acres at a cost of $1.95 an acre. The efficiencies gained through the use of combines with an auxiliary motor most probably offset the additional cost of operation, according to the farmers interviewed.

11. The average annual cost of operating hay balers was as follows: stationary tractor-powered balers, $33.69; stationary balers with an auxiliary motor, $69.65; and pick-up balers, $183.22. The acreage harvested was greatest for pick-up balers, an average of 164 as compared with 102 acres for stationary balers with the auxiliary motor and 97 acres for stationary tractor-powered balers. The cost of operating balers per acre was $1.12 for pick-up balers, $0.68 for stationary balers with an auxiliary motor, and $0.34 for stationary tractor-powered balers.

12. The adoption of one medium-sized tractor provides sufficient power to displace 6 head of workstock. Workstock numbers had not been reduced to this extent on the farms surveyed; consequently, over-all power costs were higher than necessary on the farms surveyed and may be reduced significantly.

13. The type of power used in crop production is an important factor affecting total labor requirements and the distribution of these requirements throughout the year. Labor requirements were reduced substantially when mechanized methods of production were employed, ranging from a reduction of 9.9 per cent for cotton, which was only partially mechanized, to 47 per cent in the production of oats.

14. The distribution of power requirements for crop production throughout the year largely determines the maximum acreage that can be operated by a single power unit.

15. Many opportunities exist on farms in the delta cotton areas for sizable reductions in the cost of power and equipment. Some of the more important means of reducing costs are as follows: reduction in workstock, increased annual use, more custom work, efficiently sized farms, cooperative ownership, wise purchase of good second-hand equipment, adaptation of the power unit to the farm and to the job to be done, and better care of tractors and equipment.

TECHNOLOGY AND SCIENCE ROOM

APPENDIX TABLE 1. AVERAGE PURCHASE PRICE OF COMPLEMENTARY TRACTOR EQUIPMENT AND ANNUAL OPERATING COSTS PER MACHINE ON FARMS REPORTING, IN THE MISSISSIPPI RIVER DELTA COTTON AREA, 1944[1]

Item	*Number*	*Size*	*Average purchase price*	*Average age*	*Useful life left*	*Total estimated life*	*Annual depre-ciation*	*Annual repairs*	*Annual interest*[2]
			dollars	*years*	*years*	*years*	*dollars*	*dollars*	*dollars*
Disc	129	6-7 feet	187	4.5	7.1	11.6	16.11	22.15	5.61
Disc	20	8-9 feet	198	5.7	8.1	13.8	14.42	26.68	5.94
Middlebreaker	2	1 row	125	6.5	9.5	16.0	7.81	6.50	3.75
Middlebreaker	94	2 row	162	4.6	8.7	13.3	12.20	12.55	4.86
Middlebreaker	14	3 row	172	3.5	10.0	13.5	12.75	13.14	5.16
Disc plow	27	2 pan	174	6.0	8.5	14.5	12.04	13.08	5.24
Disc plow	44	3 pan	200	4.9	7.8	12.7	15.75	22.41	6.00
Disc plow	3	4 pan	226	6.0	6.7	12.7	17.80	18.33	6.78
Disc plow	3	5 pan	254	4.3	5.7	10.0	25.40	11.67	7.62
Harrow	42	8-12 feet	48	3.8	4.5	8.3	5.76	4.76	1.43
Harrow	15	14-16 feet	83	5.3	5.6	10.9	7.62	7.67	2.49
Planter	38	2 row	128	3.2	8.9	12.1	10.57	6.23	3.84
Planter	4	4 row	300	3.8	10.0	13.8	21.72	12.25	9.00
Cultivator	124	2 row	162	3.8	8.2	12.0	13.51	19.82	4.86
Cultivator	9	4 row	281	3.2	9.1	12.3	22.87	21.11	8.44
Grain drill	39	8-14 feet	196	5.9	7.9	13.8	14.20	9.47	5.88
Mower	53	6-7 feet	145	3.6	6.2	9.8	14.81	25.63	4.36
Rake (side delivery)	16	8 feet	149	5.1	8.3	13.4	11.09	5.11	4.46
Rake (side delivery)	1	9 feet	165	1.0	14.0	14.0	11.00	3.00	4.95
Rake (side delivery)	2	10 feet	190	3.0	2.5	5.5	34.55	10.00	5.70
Rake (dump)	4	8 feet	45	7.8	9.5	17.3	2.60	4.50	1.35
Rake (buck)	6	8-12 feet	84	2.8	7.5	10.3	8.19	9.17	2.53
Stalk cutter	34	2 row	98	2.8	9.6	12.4	7.89	7.93	2.93
Trailers	12	2 wheel	84	3.7	8.1	11.8	7.14	10.00	2.53
Trailers	46	4 wheel	152	5.3	8.1	13.4	11.32	17.54	4.55

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[1] Average for 120 farms reporting, 94 farms with tractors.

[2] Interest charged at 6 per cent on one-half of the average purchase price.

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Louisiana Bulletin No. 418 June 1947

FINANCIAL RESULTS OF THE OPERATION OF RAW SUGAR MILLS IN LOUISIANA FOR NINE YEARS, 1937 TO 1945

By

J. Norman Efferson and Mildred Cobb

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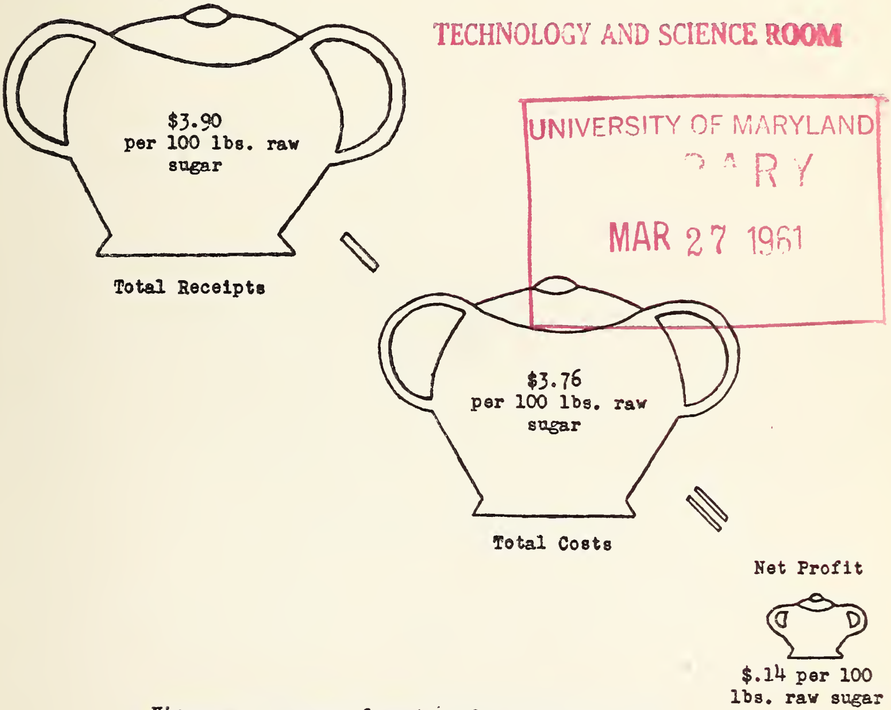

Nine-year average of costs and returns per 100 pounds of raw sugar made

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. Taggart, *Director*

TABLE OF CONTENTS

PAGE

INTRODUCTION ... 5

METHOD OF PROCEDURE ... 5

- Items of Cost ... 6
- Measures of Net Cost and Return ... 8
- Other Considerations ... 8

AVERAGE RESULTS FOR THE NINE YEARS ... 9

- Volume of Business ... 9
- Net Returns Per Mill ... 10
- Costs and Returns Per Ton of Cane Ground ... 12
- Costs and Returns Per 100 Pounds of Sugar Manufactured ... 14
- Nine-Year Average Costs and Returns ... 15

FACTORS AFFECTING COSTS AND RETURNS ... 17

- Mill Capacity ... 18
- Amount of Cane Ground ... 19
- Sugar Manufactured Per Ton of Cane Ground ... 20
- Geographic Variations ... 21

SUMMARY ... 22

APPENDIX ... 25

LIST OF TABLES

TABLE PAGE

1. Average volume of cane ground and raw sugar manufactured by Louisiana sugar mills, 1937 to 1945 ... 9
2. Average net returns from the production of raw sugar in Louisiana, 1937 to 1945 ... 11
3. Costs and returns per ton of cane ground by sugar cane mills in Louisiana, 1937 to 1945 ... 12
4. Costs and returns per 100 pounds of sugar manufactured by sugar cane mills in Louisiana, 1937 to 1945 ... 14
5. Summary table showing 9-year average per mill, per ton cane ground and per 100 pounds sugar manufactured, of costs and returns of Louisiana raw sugar mills, 1937-1945, inclusive ... 16

APPENDIX TABLES

TABLE PAGE

I. Costs and returns from the operation of sugar mills in Louisiana showing average per ton of cane ground for the years 1937 through 1945, inclusive.. 25

II. Costs and returns from the operation of sugar mills in Louisiana showing average per mill for the years 1937 through 1945, inclusive.... 26

III. Costs and returns from the operation of sugar mills in Louisiana showing average per 100 pounds of sugar manufactured for the years 1937 through 1945, inclusive........ 28

IV. Summary table showing 3-year averages, 1937 through 1945, per mill, per ton of cane ground, and per 100 pounds of sugar manufactured, of costs and returns of raw sugar mills in Louisiana........ 29

V. Relation between the capacity of sugar mills and the cost, per 100 pounds, of operating raw sugar mills in Louisiana, 1937 through 1945, inclusive.... 30

VI. Relation between the capacity of sugar mills and the income per 100 pounds of raw sugar manufactured by Louisiana mills, 1937 through 1945, inclusive 31

VII. Relation between the volume of cane ground and the average costs per 100 pounds of raw sugar manufactured by Louisiana mills, 1937 through 1945, inclusive 32

VIII. Relation between the volume of cane ground and the income per 100 pounds of sugar manufactured by mills in Louisiana, 1937 through 1945, inclusive 33

IX. Relation between the yield of sugar obtained per ton of cane and the average costs per 100 pounds of sugar manufactured of operating sugar mills in Louisiana, 1937 through 1945, inclusive........ 34

X. Relation between the yield of sugar obtained per ton of cane and the income per 100 pounds of raw sugar manufactured in mills in Louisiana, 1937 through 1945, inclusive 35

XI. Geographic variations in the financial results obtained from the operation of sugar mills in Louisiana for the years 1937 through 1945, inclusive—the Teche Region 36

XII. Geographic variations in the financial results obtained from the operation of sugar mills in Louisiana for the years 1937 through 1945, inclusive—the Mississippi Region 36

FINANCIAL RESULTS OF THE OPERATION OF RAW SUGAR MILLS IN LOUISIANA FOR NINE YEARS, 1937 to 1945

By

J. NORMAN EFFERSON AND MILDRED COBB

INTRODUCTION

Detailed studies of the costs and returns from the operation of raw sugar mills in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station each year since 1937.[1] In each year, the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. Records were collected from 30 mills in 1937, 32 in 1938, 42 in 1939, 38 in 1940, 36 in 1941, 32 in 1942, 32 in 1943, 29 in 1944, and 22 in 1945.[2] During this nine-year period there were between 40 and 50 mills in the state which manufactured primarily raw sugar; thus the sample studied represents about two-thirds of the raw sugar mills and also represents about two-thirds of the total raw sugar production in the state. Consequently, the sample secured was large enough to be representative of the industry as a whole.

The purpose of this report is to present a summary of the financial results of the operation of raw sugar mills in Louisiana for the nine-year period 1937 to 1945 and to make comparisons of significant trends during the period.

METHOD OF PROCEDURE

Selection of the mills for the sample was determined by the degree of cooperation assured by the managers and bookkeepers and the accuracy of the records involved. For the most part, identical mills were studied throughout the nine-year period. With the exception of one replacement, the mills studied in the 1943 analysis were the same as those used in the 1942 study. Twenty-nine of the 32 mills studied in 1943 were used in the 1944 analysis. The omission of earlier cooperators and their replacement with new cooperators in the studies for recent years was made necessary because of shifts in the type of sugar produced by some mills. Since the study was limited to an analysis of raw sugar producers, any mill that shifted from the production primarily of raw sugar to the production mostly of direct consumption sugars was omitted and replaced with a new raw sugar producer.

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[1] *Financial Results of the Operation of Sugar Mills in Louisiana, 1937 and 1938* (Louisiana Experiment Station Bulletin No. 316, February, 1940); *Financial Results of the Operation of Sugar Mills in Louisiana, 1939 to 1941* (Louisiana Experiment Station Bulletin No. 373, March, 1944); *Costs and Returns of Operating Raw Sugar Mills in Louisiana, Crop Year 1942* (Dept. of Agricultural Economics Mimeo. No. 37, November, 1943); *Financial Results of the Operation of Raw Sugar Mills in Louisiana, 1943 and 1944* (Dept. of Agricultural Economics Mimeo. No. 48, March, 1945).

[2] The field schedules for the 1937 and 1938 studies were collected by Roy A. Ballinger; for 1939, 1940, and 1941, by Roy A. Ballinger and Reid M. Grigsby; for 1942, by Roy A. Ballinger and W. H. Alexander; for 1943, by J. Norman Efferson and W. H. Alexander; and for 1944 and 1945, by J. Norman Efferson.

The total costs of operating the mills were divided into five main groups, with each group subdivided into various items. These groupings were determined very largely by the customary practices of the mills in keeping their accounts. Since accounting practices varied somewhat between mills, however, it was necessary to make certain adjustments in the accounts of some of the mills in order to fit them into the arrangement used in this study. In some cases it was necessary to make estimates as to the allocation of costs under the different headings; these estimates were in all cases made by the manager or some other official of the mill. Such allocations affect the distribution of costs between items; they do not affect the total cost of any mill.

Items of Cost

General overhead expenses include those items which could not be accurately allocated to the other divisions. The labor charge under general overhead includes payments for general management and supervision, and clerical and accounting work. Materials include such items as postage, printing, stationery, and office supplies. "Other" expenses include telephone, telegraph, travel, bad debts, contributions, and other miscellaneous overhead items. Taxes (not including state and federal income taxes), insurance, and depreciation have been included as a part of general overhead expenses since the information in the records of most mills was not in such form as to permit a satisfactory division of these items among the other groups of cost. In the cases where one company operated both a raw sugar mill and a sugar cane farm or farms, or where one company operated more than one mill, and maintained a central office for the administration of the multiple-unit enterprises, certain of the general overhead costs, such as clerical labor, office supplies, and other similar items, had to be allocated to the mill and to the other enterprises on a percentage basis, usually established on the volume of business of the different enterprises. In all cases these percentage allocations were made by one or more officials of the operating company.

The costs shown under procurement of cane include the purchase of cane from independent growers and the cost of transporting it from the field loading stations to the mills. In those cases where cane was obtained from lands operated by the mill, the cost of cane to the mill was considered to be the amount which would have been paid to the independent grower for the same tonnage. Transportation costs for this cane also were included. Most of the mills kept their records in such a way as to show the cost in this manner; in some instances where they did not do so, the records were adjusted to this basis. The transportation charges are composed of amounts paid for railroad freight, truck contract hauling, operation of hoists and derricks, operation of on-farm railroads, and other miscellaneous items connected with the cost of transportation. The transportation costs as shown are somewhat understated because it was not possible to segregate all of the items that should have been included. Depreciation on transportation equipment, such as trucks, on-farm railroads, and similar items, was included in the depreciation item in overhead costs. In a similar manner, no boardinghouse costs were included in transportation charges, although in many cases part or all of the labor employed in transporting cane was fed at the boardinghouse. Also, some part of the labor cost of supervision could be properly charged to transportation, but no basis could be established for determining what part; thus, all supervision costs were charged to overhead. The importance of these items is not very great, but their existence should be recognized.

The costs grouped under manufacture of sugar include those items that were concerned most directly with the actual process of making sugar. Under labor is included all labor not specifically assigned to general overhead or procurement of cane. The cost for fuel includes only fuel purchased and does not include any allowance for bagasse which the mills produced and burned. The costs for lime, sulphur, bags, twine, laboratory and other supplies represent the amount paid for the quantities actually used during the fiscal years. Off-season or dead-season repair costs have been divided between labor and materials. The item "Other" includes such items as lubricants, waste, lights, and other miscellaneous items. In some cases where the cost accounts of a mill were divided into other groupings which did not follow the general scheme used in this study, it is possible that certain items were included in "Other" which belonged elsewhere. Such cases were relatively few, however, and would not affect greatly the distribution of costs and would not affect the total costs to any extent.

Selling costs cover the amounts actually paid for commissions and brokerage charges, weighing and gauging, freight and drayage on products sold, storage where space was rented, and allowances made to buyers for any reason. No attempt was made to allocate any part of the general overhead costs to selling, because there was no adequate basis for making such an allocation. It is certainly true, however, that some part of the general overhead costs was incurred in connection with the selling operations.

The interest cost was calculated at 5 per cent of the total value of the assets used in the business. Interest actually paid by the various mills for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This procedure placed all mills on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. The use of the 5 per cent rate in computing interest costs was largely arbitrary. The effect of using a different rate can be determined by applying any desired rate to the capital investment.

Measures of Net Cost and Return

The net cost of manufacturing raw sugar was determined by subtracting miscellaneous credits from the total cost. Miscellaneous credits consist of the income received by the mills from any source except the sale of raw sugar. Such income was largely received from the sale of molasses, syrup, and sugar other than raw sugar. In addition, some income was received from the sale of scrap iron and other miscellaneous products. The production of these items was for the most part incidental to the business of manufacturing raw sugar; thus, the income from their sale may be regarded as having reduced the cost of manufacturing raw sugar below what it would have been otherwise.

Total income of the mills includes the receipts from all sales made by the mills, including both raw sugar and the items accounted for in connection with miscellaneous credits. Differences in inventory of products for sale at the beginning and end of each year have been included in calculating income.

Operating expenses include all of the costs except interest on capital. Net operating income is the difference between total income from all sources and operating expenses. It represents the earnings available for the payment of interest, dividends, and additions to surplus. Net income is the amount remaining after subtracting interest at the rate of 5 per cent from the net operating income.

Other Considerations

The method used in computing average interest costs is subject to some limitations but is used in an effort to make interest costs comparable for all mills. The only accurate figure available as to the total assets on the books of most of the mills studied was the "depreciated assets" item as used for federal and state income tax purposes. Since many of the older mills have depreciated their assets heavily during the course of time, the capital investment data as used in these studies to compute interest charges are lower than the book value, replacement cost, or sales value of the property. As a result, the interest cost for such mills is much lower than the interest which would have had to be paid if the property were purchased on the open market with the use of borrowed funds.

In interpreting the average operating income before interest and the net income after interest, it should be noted that these two measures of return or profit are the returns *before income taxes,* since no state or federal income taxes are included in the cost items. Income taxes were excluded from the items of cost in order to obtain an average cost per mill and per unit of production which would be directly comparable. This procedure gives more accurate cost data for comparing mill to mill in any one year or averages over a period of years. However, it also overstates the actual profit made by the business and the profit returned to the operators or stockholders.

The amount of cane ground by the mills is reported in mill tons, that is, the actual weight of the cane regardless of its sucrose content. The amount of raw sugar manufactured is in terms of 96-degree equivalent rather than the actual weight of the sugar made.

AVERAGE RESULTS FOR THE NINE YEARS

A brief summary of the average results for each of the nine years studied is shown in Tables 1 through 5. A more detailed analysis of the final results for each year on a per mill, per ton ground, and per hundred pounds of sugar made basis, is presented in Appendix Tables I through XII.

Volume of Business

The average volume of business for the mills studied for each year from 1937 to 1945, including the tons of cane ground per mill, the pounds of raw sugar manufactured per mill, and the average number of pounds of sugar made per ton of cane ground, is shown in Table 1. These results reflect the wide variation that has occurred from year to year in

TABLE 1. AVERAGE VOLUME OF CANE GROUND AND RAW SUGAR MANUFACTURED BY LOUISIANA SUGAR MILLS, 1937 TO 1945

Year	Number of mills	Average per mill		Average number of pounds of sugar manufactured per ton of cane ground
		Tons of cane ground	Pounds of sugar manufactured	
1937	30	75,561	11,693,449	154.8
1938	32	83,012	14,141,279	170.4
1939	42	74,028	12,917,332	174.5
1940	38	44,447	7,267,582	163.5
1941	36	62,456	10,487,408	167.9
1942	32	76,491	13,052,404	170.6
1943	32	87,117	14,009,962	160.8
1944	29	84,987	12,983,639	152.8
1945	22	87,095	13,556,532	155.7

the size of the Louisiana sugar cane crop due to weather conditions, since the acreage has been relatively stable. For the period covered, the average tonnage of cane ground varied from a low point of less than 45,000 tons per mill in 1940 to more than 87,000 tons per mill in 1943 and 1945. The large volume ground per mill in 1945, however, is due not only to relatively favorable weather conditions and good yields per acre in 1945 but also to another trend that is occurring in the area. From 1943 to 1945, several raw sugar mills in Louisiana went out of business and the tonnage of cane that normally went to these mills was shifted to other mills, resulting in a larger volume of business per mill in 1945 than in earlier years even though the relative size of the crop for that year did not increase by a like amount.

The pounds of raw sugar manufactured per mill varied from a low point of about 7,000,000 pounds (3,500 short tons) in 1940, to more than 14,000,00 pounds (7,000 short tons) in 1938 and in 1943. This factor is affected by both the volume of cane ground and the quality and average sucrose content of the crop. As a result, even though the tonnage ground per mill was about the same in 1945 as in 1943, these mills produced an average of about one-half million pounds of raw sugar less per mill in 1945 than in 1943 because of a relatively low recovery rate obtained in 1945.

The average recovery rate, or the amount of sugar manufactured per ton of cane ground, varied from 174.5 pounds per ton in 1939 to 152.8 pounds per ton in 1944. The facts indicate that there is a trend toward a decreasing rate of recovery in the Louisiana sugar cane area as indicated by the low rate of recovery obtained in the last three years of the study, 1943 to 1945. From 1939 to 1943, the sugar recovery per ton of cane ground varied from 164 to 175 pounds, averaging almost 170 pounds per ton for the five-year period. From 1943 to 1945, the same rate varied from 153 to 161 pounds per ton, averaging about 156 pounds per ton for this three-year period—14 pounds, or 8 per cent, less than the previous five-year average. Preliminary results for the 1946 grinding season indicate that this same declining trend has continued through 1946.

Net Returns per Mill

The average investment per mill, the net operating income before interest charges and the net income after interest on a per mill basis, and the per cent return on investment before interest and taxes for each of the nine years are shown in Table 2.

Total assets, which represent the depreciated value of all buildings, machinery, and equipment used in the operation of these raw sugar mills, averaged about $400,000 per mill in the pre-war period from 1937 to 1941 but increased to more than $450,000 per mill in 1944 and 1945. This trend toward an increased investment to operate the same relative

TABLE 2. AVERAGE NET RETURNS FROM THE PRODUCTION OF RAW SUGAR IN LOUISIANA, 1937 TO 1945

Year	Number of mills	Average per mill			
		Total assets	Net operating income	Net income	Per cent return on investment before taxes*
	Number	*Dollars*	*Dollars*	*Dollars*	*Per cent*
1937..........	30	390,253	18,764	− 749	4.81
1938..........	32	389,398	22,695	3,468	5.83
1939..........	42	329,857	39,884	23,391	12.09
1940..........	38	350,993	1,635	−15,915	0.47
1941..........	36	400,360	63,973	43,955	15.97
1942..........	32	401,528	63,730	43,653	15.87
1943..........	32	446,299	61,444	39,129	13.77
1944..........	29	452,977	11,212	−11,437	2.48
1945..........	22	454,776	50,064	27,325	11.01

*Computed by dividing the net operating income by the total assets. Since the net operating income does not include a deduction for actual interest costs or for computed interest costs, this return overstates the actual return by the amount actually paid as interest on borrowed funds.

volume of business is due to higher replacement costs during the war years for all items of machinery and equipment. This trend is expected to increase at an accelerated rate during the next few years because the shortage of machinery and equipment during the war years has caused most mill operators to delay the purchase of many essential items which must be obtained to replace worn-out equipment in the near future if they are to continue to operate the same volume of business.

The net operating income, or the excess of receipts over expenses other than interest and income taxes, varied from less than $2,000 per mill in 1940 to about $64,000 per mill in 1941 and 1942. In three years of the nine the net operating income per mill averaged less than $20,000 and in three years of the nine, the net operating income amounted to $60,000 per mill or more.

In terms of the percentage return on the capital investment, this net operating income amounted to less than 1 per cent in 1940, was less than 6 per cent in four of the nine years, and was more than 10 per cent in four of the nine years. The average net operating income per mill reached a high point in the 1941-43 period but declined drastically in 1944 and 1945. The amount of the decline in 1945 is indicated only partially by the net operating income for that year, since almost one-half of the indicated net operating income of about $50,000 per mill earned in 1945 was made up of the temporary governmental assistance payment of fifteen cents per hundred pounds of sugar manufactured. This payment was not made in the years previous to 1945, nor was it made for the 1946 grinding season.

The net income, or the excess of receipts over expenses plus a charge of 5 per cent of the average capital investment to cover all interest costs, resulted in a loss of more than $15,000 per mill in 1940, an indicated loss in three of the nine years studied and a high point of about $44,000 per mill in 1941 and 1942. The average net income per mill for the two most recent years studied has not been promising. In 1944, a net loss of more than $11,000 occurred. In 1945, an average net income of $27,000 per mill was earned; about $20,000 of this amount, or 75 per cent, was composed of the temporary governmental payment which was made for the 1945 season to cover increased costs in lieu of a price increase. This payment was discontinued after the 1945 season.

Costs and Returns per Ton of Cane Ground

A summary of the average costs and returns per ton of cane ground for the mills studied from 1937 to 1945 is presented in Table 3. A more detailed outline of the unit costs for each item of expense is summarized in Appendix Table I.

Unit costs per ton of cane ground averaged about $5.00 per ton in the 1937-39 period but increased to more than $7.00 per ton for the most recent period, 1943-45. General overhead costs and interest costs

TABLE 3. Costs and Returns Pfr Ton of Cane Ground by Sugar Cane Mills in Louisiana, 1937 to 1945

Items of cost and return	Dollars per ton of cane ground								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
Costs:									
General overhead	.53	.44	.56	.79	.67	.59	.55	.59	.56
Procurement of cane	3.42	3.12	3.19	3.14	4.12	4.82	4.75	4.65	4.66
Manufacture of sugar	.94	.88	.92	1.24	1.10	1.14	1.31	1.48	1.46
Selling	.24	.25	.26	.18	.15	.15	.20	.16	.10
Interest	.26	.23	.22	.39	.32	.27	.26	.27	.26
Total	5.39	4.92	5.15	5.74	6.36	6.97	7.07	7.15	7.04
Miscellaneous credits	.48	.32	.45	.57	1.75	1.35	1.52	1.32	1.59
Net costs	4.91	4.60	4.70	5.17	4.61	5.62	5.55	5.83	5.45
Income:									
Raw sugar	4.90	4.64	5.02	4.82	5.31	6.19	6.00	5.70	5.76
Miscellaneous	.48	.32	.45	.57	1.75	1.35	1.52	1.32	1.59
Total	5.38	4.96	5.47	5.39	7.06	7.54	7.52	7.02	7.35
Operating expenses	5.13	4.69	4.93	5.35	6.04	6.70	6.81	6.88	6.78
Net operating income	.25	.27	.54	.04	1.02	.84	.71	.14	.57
Net income	−.01	.04	.32	−.35	.70	.57	.45	−.13	.31
Capital investment	5.16	4.69	4.45	7.89	6.41	5.25	5.12	5.33	5.22

were relatively stable throughout the nine-year period and selling costs decreased more than 50 per cent from the 1937-39 period to 1944 and 1945; this cost decrease was due to the increased demand for sugar during the war years relative to supplies and to governmental absorption of part of the transportation expenses. Substantial increases occurred, however, in the costs per ton for the procurement of cane and the manufacture of sugar. Expenses involved in the procurement of cane, including costs of cane purchased, plus labor and transportation charges, increased from slightly more than $3.00 per ton in the 1937-39 period to more than $4.50 per ton in 1944 and 1945.

Costs for the manufacture of sugar, which are mostly labor costs, increased from about $0.90 per ton in the 1937-39 period to about $1.50 per ton in 1944 and 1945. Direct labor charges in the costs for the manufacture of sugar increased from less than $0.40 per ton in the earlier period to more than $0.60 per ton in the most recent three-year period. The cost increases which occurred in the "procurement of cane" item were due to increased expenses for labor and transportation and to the increased price which was paid for cane under the usual grower-processor contract. The increased expenses in the manufacture of sugar item is due to some extent to the increased costs for materials such as fuel, lime, sulphur, and supplies for repairs, but is due mostly to increased labor costs for operations and for repairs.

Miscellaneous credits involved in the operations of these sugar mills, which included income received from the sale of molasses, small amounts of direct-consumption sugars, and all other income except the sale of raw sugar, also increased during the period studied. These items of income increased from about $0.40 per ton in the 1937-39 period to more than $1.50 per ton of cane ground in 1945. Income from the sale of molasses resulting from the increased price received for blackstrap which occurred during the war years accounted for the major part of this added income; molasses income increased from about $0.25 per ton in the 1937-39 period to $1.25 per ton in the 1943-45 period.

As a result of the increase in income from miscellaneous credits, the net cost per ton of cane ground, which is the difference between total costs and miscellaneous credits, did not increase at the same rate as total costs per ton. Average net costs per ton of cane ground varied from less than $5.00 per ton in 1938 and 1939 to $5.75 to $6.00 in the 1943-45 period.

Income from raw sugar sales also increased during the period but not at as rapid a rate as did total costs or miscellaneous credits per ton. Raw sugar sales amounted to slightly less than $5.00 per ton of cane ground in the 1937-39 period and increased to about $5.75 per ton of cane ground in 1944 and 1945.

The average net operating income varied from a high point of about $1.00 per ton of cane ground in 1941 to less than $0.30 per ton in 1937, 1938, 1940, and 1944. The average net income after interest indicated net losses per ton in 1937, 1940, and 1944, and net gains of more than $0.50 per ton in 1941 and 1942.

Costs and Returns per 100 Pounds of Sugar Manufactured

A summary of the average costs and returns per 100 pounds of raw sugar manufactured, 96-degree basis, for the mills studied from 1937 to 1945 is presented in Table 4. A more detailed outline of the unit costs per 100 pounds of raw sugar for each item of expense is summarized in Appendix Table III.

Unit costs per 100 pounds of raw sugar made varied from about $3.00 in 1938 and 1939 to $4.50 per 100 pounds in the 1943-45 period.

TABLE 4. COSTS AND RETURNS PER 100 POUNDS OF SUGAR MANUFACTURED BY SUGAR CANE MILLS IN LOUISIANA, 1937 TO 1945

Items of cost and return	Dollars per 100 pounds of sugar								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
Costs:									
General overhead	.34	.26	.32	.49	.40	.34	.34	.39	.36
Procurement of cane	2.21	1.83	1.83	1.92	2.46	2.83	2.96	3.05	2.99
Manufacture of sugar	.60	.52	.53	.76	.65	.67	.82	.97	.94
Selling	.16	.15	.15	.11	.09	.09	.12	.10	.06
Interest	.17	.13	.13	.24	.19	.15	.16	.17	.17
Total	3.48	2.89	2.96	3.52	3.79	4.08	4.40	4.68	4.52
Miscellaneous credits	.31	.19	.26	.35	1.04	.79	.95	.87	1.02
Net costs	3.17	2.70	2.70	3.17	2.75	3.29	3.45	3.81	3.50
Income:									
Raw sugar	3.16	2.73	2.88	2.95	3.17	3.63	3.73	3.73	3.70
Miscellaneous	.31	.19	.26	.35	1.04	.79	.95	.87	1.02
Total	3.47	2.92	3.14	3.30	4.21	4.42	4.68	4.60	4.72
Operating expenses	3.31	2.76	2.83	3.28	3.60	3.93	4.24	4.51	4.35
Net operating income	.16	.16	.31	.02	.61	.49	.44	.09	.37
Net income	–.01	.03	.18	–.22	.42	.34	.28	–.08	.20
Capital investment	3.34	2.75	2.55	4.83	3.88	3.08	3.19	3.49	3.35

As in the case of unit costs per ton of cane ground, the costs per unit of sugar manufactured for the general overhead and interest items remained stable throughout the period, selling costs decreased, and unit costs increased for the procurement of cane and manufacture of sugar expense items.

Net costs per 100 pounds of raw sugar manufactured, computed by deducting miscellaneous credits per unit from total costs per unit, varied from a low of $2.70 per 100 pounds in 1938 and 1939 to $3.81 in 1944, and $3.50 in 1945; the 1945 figure for actual operations not including the government assistance payment is $3.65 per 100 pounds of raw sugar. The income from raw sugar varied from less than $3.00 per hundred pounds in 1938 and 1939 to slightly more than $3.70 per hundredweight of sugar in the 1943-45 period. The ceiling price for raw sugar during the latter part of this period was $3.75 per hundred pounds of sugar; this ceiling, however, was established at the refinery, and under the usual accounting practices of the mills studied, the net price received at the mill, or the ceiling price minus transportation to the refinery, was reported as the price received for sugar.

The net operating income per 100 pounds of sugar manufactured varied from a high point of $0.61 per 100 pounds in 1941, to less than $0.10 in 1940 and 1944. The net income after interest per 100 pounds indicates losses in 1937, 1940, and 1944; net incomes of less than $0.25 in 1938, 1939, and 1945; and a net income of more than $0.40 per hundred pounds in only one year, 1941.

It is interesting to note that from the pre-war period of 1937-40 to the most recent period, 1943-45, the income from blackstrap molasses increased from about $0.20 per 100 pounds of raw sugar made to about $0.80, or an increase of about $0.60 per hundred pounds of raw sugar manufactured. Neither the net operating income per 100 pounds nor the net income approached $0.60 per hundred pounds during the 1943-45 period; thus, the major reason these mills continued to make net profits, on the average, during the latter years of the war, in spite of a fixed ceiling price for raw sugar and increasing costs for all items, was because of the increased income from blackstrap molasses. These facts serve to verify the frequently stated opinion of many Louisiana sugar processors that during the war they produced raw sugar at a loss and made their profits on their share (the grower is paid a share of the income from blackstrap molasses under the usual cane purchase contract) of that once worthless by-product, blackstrap molasses. This brings up the question as to what is to happen to costs and returns when molasses prices revert to pre-war levels. It appears from the cost and return data that one or more of three things must happen if molasses prices decline materially and industry earnings are maintained: unit costs must be reduced by increased efficiencies in mill operations, raw sugar prices must be maintained above pre-war levels, and/or increased income must be received from other by-products of the industry.

Nine-Year Average Costs and Returns

A summary of the average costs, returns, and net profits for all the mills studied for the entire nine-year period, 1937 to 1945, is shown in Table 5. These data are computed on the basis of a weighted average for the entire period; the use of weighted averages for this computation is the most conservative one, since the use of a nine-year simple average results in slightly higher average costs and lower average returns because of a larger number of mills in the sample in one or two of the earlier years when returns were low.

TABLE 5. SUMMARY TABLE SHOWING 9-YEAR AVERAGE PER MILL, PER TON CANE GROUND AND PER 100 POUNDS SUGAR MANUFACTURED, OF COSTS AND RETURNS OF LOUISIANA RAW SUGAR MILLS, 1937-1945, INCLUSIVE

Item	9-Year average		
	Average per mill	Average per ton cane ground	Average per 100 lbs. sugar made
	Dollars	*Dollars*	*Dollars*
Costs:			
General overhead	42,357.48	.58	.35
Procurement of cane	293,453.40	3.98	2.43
Manufacture of sugar	84,641.80	1.15	.70
Selling	14,268.13	.19	.12
Interest	19,776.37	.27	.16
Total	454,497.18	6.17	3.76
Miscellaneous credits	75,359.81	1.02	.62
Net cost	379,137.37	5.15	3.14
Income:			
Raw sugar	396,089.84	5.38	3.28
Miscellaneous	75,359.81	1.02	.62
Total	471,449.65	6.40	3.90
Operating expenses	434,720.81	5.90	3.60
Net operating income	36,728.84	.50	.30
Net income	16,952.47	.23	.14
Capital investment	396,047.44	5.38	3.28
Tons cane ground	73,672		.61
Pounds sugar made	12,083,047	164.01	
Total number mills	32.5		

For the nine-year period, the mills studied produced raw sugar at an average cost of $3.76 per hundred pounds. Of this amount, 65 per cent was for the purchase of the raw material, sugar cane, and 35 per cent for operating costs. The income from miscellaneous sources, mostly blackstrap molasses, averaged $0.62 per hundred pounds of raw sugar produced, resulting in a net cost (total costs minus miscellaneous credits) of $3.14 per hundred pounds of raw sugar. These processors received an average price of $3.28 per hundred pounds for all raw sugar produced. The resulting net income amounted to an average of $17,000 per mill per year, $0.23 per ton of cane ground, or $0.14 per hundred pounds of raw sugar manufactured. In view of the fact that the average capital investment per mill amounted to about $400,000, these average returns cannot be considered excessive and are relatively low in comparison to returns from many other types of manufacturing industries for the same period of time.

In terms of the costs and returns for the manufacture of raw sugar in Louisiana, the nine-year period, 1937-45, can be characterized as a period of three favorable years, three average years, and three very unfavorable years. The three favorable years were 1941, 1942, and 1943, in which costs in relation to prices were favorable and weather conditions permitted normal season operations with fairly good yields of sugar per ton of cane ground. The three average years were 1938, 1939, and 1945; from the point of view of the historical trends, 1945 could be classified as an unfavorable year, for, although net earnings were not extremely low in that year, most of the profits made were the governmental assistance payments without which many losses would have occurred. The three unfavorable years were 1937, 1940, and 1944. Each of these seasons was characterized by relatively small crops and low recovery rates per ton ground. In the two most recent years, 1944 and 1945, increasing costs under wartime conditions, with a rigid ceiling price under O.P.A. controls, plus relatively low recovery rates per ton, caused net earnings to be low. In 1944, for instance, 19 of the 29 mills studied had net losses at the end of the year's operations.

A summary of the average costs and returns for each of the three-year periods, 1937-39, 1940-42, and 1943-45, is shown in Appendix Table IV. The average net income per hundred pounds of raw sugar manufactured amounted to $0.08 in the 1937-39 period; $0.37 for the middle period, 1940-42; and declined to $0.21 for the most recent three-year period.

Total costs per unit for producing raw sugar increased 25 per cent from the first to the second three-year period and increased 18 per cent from the second to the third three-year period. The price of raw sugar increased 13 per cent from the first to the second period and 13 per cent from the second to the final average. Net incomes were maintained only because of the increase in the income from blackstrap molasses.

The trends in recovery rates are also significant. In the 1937-39 and the 1940-42 periods, these mills averaged from 167 to 168 pounds of raw sugar per ton of cane ground as compared with only 156.7 pounds per ton for the three-year period 1943-45.

FACTORS AFFECTING COSTS AND RETURNS

The unit costs and returns in the operation of raw sugar mills in Louisiana are affected by a great number of diverse factors, some under the control of the management and many beyond control of the individual operators. The major factors determining the unit costs, returns, and net profits from the manufacture of raw sugar, as indicated by the Louisiana raw sugar mill studies from 1937 to 1945, appear to be the annual variations in the size of the crop, which is determined more by the weather than by the acreage planted, since the acreage is relatively stable from year to year; the kind of prevailing weather during the grinding season and the presence or absence of damaging frosts; the yield of sugar per ton of cane ground, which is determined in the short run by the weather and other factors, such as the amount of trash, etc.; and the price received for raw sugar and blackstrap molasses. The favorable or unfavorable effect of the first three of these four factors is dependent, in any one year, on the weather. In comparison to most other manufacturing industries, sugar mill operations must be considered relatively risky and speculative enterprises because of this great dependence on uncontrollable and unforeseen climatic conditions for profits or losses in any one year.

The last of these four major factors, the price of sugar and molasses, is also beyond the control of the individual operator. Sugar and molasses prices are established at national and international levels. Also, because sugar supplies produced in Louisiana make up only about 7 per cent of normal consumption requirements in the United States, the Louisiana sugar production has little effect on sugar supplies for the nation as a whole; therefore, producers and processors in this state do not have the advantage held by some agricultural areas of a short crop usually being accompanied by a compensating high price. For this region, historical price trends indicate that a short crop is just as likely to be accompanied by a relatively low price as by a high price.

The financial results of the raw sugar mill studies in Louisiana from 1937 to 1945 show, however, that in any given year and under the same climatic conditions and the same price structure, there are still variations from mill to mill in costs, returns, and net profits. It follows then that there are reasons for variations in returns other than the major ones listed heretofore. These factors causing one mill to have lower costs and higher returns than another in the same area in the same year are both physical and economic in character. Since this series of studies has been limited to a statistical analysis of the final results for each year, no attempt has been made to study the physical and internal-management problems of the raw sugar mills, although it is recognized that differences do exist and that these variations cause much of the final differences in costs, returns, and net incomes. The financial factors that were found to be important in affecting costs, returns, and profits from the annual statistical analysis of the Louisiana mills are mill capacity, amount of cane ground, and sugar manufactured per ton of cane ground.

Mill Capacity

Over the past 20 years, the number of sugar mills in Louisiana has been decreasing gradually and the average size or capacity of the mills has been increasing. Changes in the technique of manufacturing sugar and in the transportation of cane appear to have been largely responsible for these trends. An analysis of the financial results obtained by large- and by small-capacity mills in Louisiana from 1937 to 1945 indicates that perhaps the trend towards larger mills should continue, although it is recognized that many factors other than those concerning information which has been obtained in these studies will have an important influence on future trends.

The relationship of mill capacity to costs and returns for the mills studied from 1937 to 1945 is shown in Appendix Tables V and VI. During the period of time covered by these studies, the general trend has been for the total cost per hundred pounds of sugar manufactured to decline as the capacity of the mill increased and for the total income per hundred pounds to increase with increased capacity. The data indicate that in seven of the nine years studied, the large-capacity mills made higher returns per mill, per ton of cane ground, and per unit of raw sugar produced than did those of relatively low capacity. For the most recent year, 1945, for instance, the mills with a daily capacity of less than 1,000 tons made an average net income of $0.04 per hundred pounds of raw sugar, the mills with a daily capacity of 1,000 to 1,499 tons produced raw sugar at a profit of $0.12 per hundred pounds, and the mills with a daily capacity of 1,500 tons or more made an average profit of $0.26 per hundred pounds of raw sugar. Similar results occurred in most of the other years, with the exception of 1940.

In 1940, when most of the mills lost money because of a very small crop, the costs per unit were actually higher for the mills with the largest capacity than they were for the smallest mills. The greatly reduced tonnage of cane ground in 1940 apparently had a more adverse effect on the large mills than it had on the small ones. Interest and overhead costs are fixed largely in amount per mill regardless of yearly variations in the size of the crop; thus, in this year of a very short crop, the fixed costs per hundred pounds of sugar increased more for the large-capacity mills than for those of relatively small capacity.

The principal advantage of the large mills in obtaining lower costs per unit in most years appears to have been in connection with the costs of manufacture and selling expenses. Each year, even including 1940, these costs were lower for the large-capacity mills than for the small ones. From 1937 to 1945, manufacturing costs for the mills with a capacity of 1,500 tons or more daily were from 5 to 25 per cent lower than manufacturing costs for the mills with a daily capacity of less than 1,000 tons.

In addition to this general relationship of capacity to costs, a very significant physical fact is shown in this analysis. In all of the years studied, the recovery factor, or the number of pounds of sugar manufactured per ton of cane ground, was greater for the large-capacity than for the small-capacity mills. Also, in most years, the small-capacity mills recovered in sugar a smaller percentage of the sucrose in the cane they ground than did the large-capacity mills. This indicates that part of the decreased costs and increased net income obtained by the large-capacity mills can be attributed to the greater technical efficiency in the large mills.

Amount of Cane Ground

The number of tons of cane ground by a sugar mill in any season is, of course, closely related to the size of the mill. This relationship, however, is by no means perfect, since some mills operate at more nearly maximum capacity or for a greater number of days than do others.

The relationship of the volume of cane ground per mill during the usual 90-day season in Louisiana to costs and returns for the mills studied from 1937 to 1945 is shown in Appendix Tables VII and VIII. In each of the nine years studied, the mills with the largest annual tonnage ground had lower costs and higher net returns than those with the smallest tonnage. In the most recent year studied, 1945, the mills grinding less than 50,000 tons per mill for the season had average costs of $5.05 per hundred pounds of sugar made and had an average net loss of $0.27 per hundred pounds of raw sugar, while the group of mills grinding 75,000 tons or more per mill for the season had average costs of only $4.54 per unit and an average net income of $0.25 per hundred pounds of raw sugar made.

The mills grinding less than 50,000 tons per year made average net losses in six of the nine years studied, the mills grinding from 50,000 to 74,999 tons for the season had net losses in three of the nine years, while the mills grinding 75,000 tons or more per season had an average net loss in only one of the nine years from 1937 to 1945.

Most of the reduction in unit costs with increased tonnages occurred in the costs of manufacturing and in selling costs. This indicates that the increased volume of business generally was associated with greater efficiency in the actual process of converting cane into sugar and in selling the increased amount produced, but had little consistent relationship to most of the other costs. As in the case of the large-capacity mills, those with the greatest tonnage for the season also obtained higher recovery rates per ton of cane ground and higher recovery rates in relation to the sucrose content of the cane.

Sugar Manufactured per Ton of Cane Ground

One of the most important factors causing differences in the unit costs, returns, and net profits from raw sugar mill operations is the number of pounds of sugar manufactured per ton of cane ground. Variations in the yield of sugar per ton of cane are caused by two major factors. One is the percentage of sucrose in the cane, and the other is the technical efficiency of the mill. Differences in the sucrose content of the cane are compensated, at least partly, by corresponding differences in the price paid for cane by the mill under the usual cane-purchase contract. Differences in the technical efficiency with which the sucrose content of the cane is converted into raw sugar are not compensated by price differentials and remain the major variable to affect the financial results achieved by the mill. It is recognized also that other factors, such as the amount of trash and immature tops, are important in determining final yields, but a study of these factors was beyond the scope of this investigation.

The relationship of the amount of raw sugar manufactured per ton of cane ground for the mills studied from 1937 to 1945 is shown in Appendix Table IX and X. In all of the years studied, there was a general tendency for the mills with relatively high average recovery per ton of cane ground to produce raw sugar at a lower cost per pound than the mills with relatively low yields of sugar manufactured per ton of cane ground. For the most recent year in which complete results are available, 1945, the mills recovering less than 150 pounds of raw sugar per ton of cane ground had average costs of $4.83 per hundred pounds of raw sugar; the group recovering from 150 to 159.9 pounds per ton produced raw sugar at a cost of $4.56 per hundred; while those mills having average recovery rates of 160 to 169.9 pounds per ton had average costs of only $4.26 per hundred pounds of raw sugar produced. Similar relationships existed in all the other years studied, with average costs per unit for the group with lowest recovery rates being from 10 to 20 per cent higher than for the group with highest rates of sugar recovered per ton of cane ground.

The most important factor causing variation in the yield of sugar per ton of cane and in the resulting differences in costs and net returns was the higher extraction obtained by the larger mills. In 1939, for instance, the proportion of the sucrose content that was recovered from the cane in the form of raw sugar was only 67.2 per cent for the group of mills that had average yields of less than 150 pounds of raw sugar per ton of cane, while the mills obtaining yields of 180 pounds of sugar per ton of cane made an average recovery of 82.5 per cent of the available sucrose in the form of raw sugar.

Geographic Variations

There appear to be important differences in operating conditions in different parts of the Louisiana area where sugar mills are located. In order to study the significance of some of these differences, the mills surveyed each year have been divided into two groups according to their geographic location. One group, referred to as mills in the Teche region, includes all mills west of the Atchafalaya River. Most of these mills are located on or close to Bayou Teche. The other group, referred to as mills in the Mississippi region, includes all of the mills studied that were situated east of the Atchafalaya River. Most of these mills are located near the Mississippi River or along Bayou Lafourche. It is recognized that there are many variations of geographic significance within each of these major regions; the number of mills included in this series of studies, however, was not large enough to warrant further division of the mills by smaller regions.

Average costs, returns, and net incomes per hundred pounds of raw sugar manufactured for the mills located in each of the two major regions from 1937 to 1945 are shown in Appendix Tables XI and XII. In most of the years studied, total and net costs per hundred pounds of sugar made were lower in the Teche than in the Mississippi region, although the difference was slight in some years. The major difference in average unit costs between the mills studied in the two regions appears to be the variation in the direct costs for the manufacture of sugar. Costs for general overhead, procurement of cane, selling, and interest have averaged about the same for each area, while direct manufacturing costs per hundred pounds of raw sugar have been somewhat less in the Teche region than in the Mississippi area.

The factors indicated to be at least partly responsible for this situation were the larger amount of sugar obtained per ton of cane ground, or the rate of recovery, as obtained by the mills in the Teche region in comparison with the Mississippi area mills, and the larger average volume of business of the Teche mills.

The variation in the yield of sugar per ton of cane ground is one of the most significant differences between the two regions. Throughout the nine years studied, the Teche region averaged from 7 to 10 pounds more raw sugar per ton of cane than the yield in the Mississippi area. This difference is primarily the result of the fact that because of climatic and soil conditions, the cane produced in the Teche area had a higher sucrose content than that grown elsewhere.

SUMMARY

1. Detailed studies of the costs and returns from the operation of raw sugar mills in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station each year since 1937. This report summarizes the results of these studies for the nine-year period, 1937 to 1945.

2. Records were collected from approximately 30 mills each year, with the sample restricted to mills which produced primarily raw sugar. For the nine-year period, the sample studied represented about two-thirds of the total raw sugar production in the state.

3. All statistical and financial data collected were obtained from the audited statements of the cooperating companies and individuals. Because of variations in bookkeeping practices, it was necessary to make some adjustments in the records of certain mills in order to keep all records on a comparable basis; these allocations affected the distribution of costs between items to a minor extent but did not affect the total cost of any mill.

4. For the period covered, the average tonnage of cane ground varied from a low point of less than 45,000 tons per mill in 1940 to more than 87,000 tons per mill in 1943 and 1945. The volume of raw sugar produced varied from about seven million pounds per mill in 1940 to fourteen million pounds per mill in 1938 and 1943.

5. From 1939 to 1943, the raw sugar recovery per ton of cane ground varied from 164 to 175 pounds, averaging almost 170 pounds

per ton for this five-year period. From 1943 to 1945, this rate varied from 153 to 161 pounds per ton, which was 14 pounds, or 8 per cent, less for this most recent three-year period than for the previous five-year average.

6. The average net income from raw sugar operations, or the excess of receipts over expenses plus interest charges, resulted in a loss of more than $15,000 per mill in 1940, an average loss in three of the nine years studied, and a high point in profits of about $44,000 per mill in 1941 and 1942.

7. Unit costs averaged about $5.00 per ton of cane ground, or $3.00 per hundred pounds of raw sugar produced, in the 1937-39 period, but increased to more than $7.00 per ton, or $4.50 per hundred pounds of raw sugar made, in the most recent period, 1943-45. Expense items increasing most rapidly during the nine-year period were direct labor costs and expenses involved in the procurement of cane.

8. The price of raw sugar also increased during this period but not at as rapid a rate as did the total costs. Income from raw sugar varied from slightly less than $3.00 per hundred pounds in the 1937-39 period to about $3.70 per unit in the 1943-45 period.

9. From the pre-war period of 1937-40 to the most recent period studied, 1943-45, the income from blackstrap molasses increased from about $0.20 per hundred pounds of raw sugar manufactured to $0.80 per hundred pounds, or an increase of about $0.60 per unit. Neither the net operating income per unit nor the net income per unit approached $0.60 per hundred pounds during the 1943-45 period; thus, the major reason these mills continued to make net profits, on the average, during some of the latter years of the war, in spite of a fixed ceiling price for raw sugar and increasing costs, was because of the increased income from blackstrap molasses.

10. It appears from the cost and return data that one or more of three things must happen if molasses prices decline materially and industry earnings are maintained: unit costs must be reduced by increased efficiencies in mill operations, raw sugar prices must be maintained above pre-war and wartime levels, and/or increased income must be developed from other by-products of the industry.

11. For the nine-year period, the mills studied produced raw sugar at an average cost of $3.76 per hundred pounds and a net cost, after deducting miscellaneous credits from total costs, of $3.14 per unit. Of the total costs, 65 per cent was for the purchase of the raw material, sugar cane, and 35 per cent for operating and overhead expenses.

12. These processors received an average price of $3.28 per hundred pounds for all raw sugar produced during the period. The resulting net income amounted to $17,000 per mill per year, $0.23 per ton of cane ground, or $0.14 per hundred pounds of raw sugar manufactured. In view of the fact that the average capital investment per mill amounted to about $400,000, these average returns cannot be considered excessive

and are relatively low in comparison to returns from many other types of manufacturing industries for the same period of time.

13. From the point of view of raw sugar processors in Louisiana, the nine-year period 1937-45 can be characterized as a period of three favorable years, three average years, and three very unfavorable years. The three favorable years were 1941, 1942, and 1943, in which costs in relation to prices were favorable and weather conditions permitted normal operations. The three average years were 1938, 1939, and 1945. The three unfavorable years were 1937, 1940, and 1944. Each of these seasons was characterized by relatively small crops and low recovery rates per ton.

14. From an analysis of historical trends, the most recent year studied, 1945, could also be classified as an unfavorable year; for, although average net earnings were not extremely low that year, most of the profits made were the governmental assistance payments to the processors, which were made for the first time in 1945 and discontinued after that season.

15. During the period of time covered by these studies, the general trend has been for the total cost per hundred pounds of sugar made to decline as the capacity of the mill increased and for total income per hundred pounds to increase with increased capacity. In seven of the nine years studied, the large-capacity mills made higher returns per mill, per ton, and per hundred pounds of sugar than did those of relatively low capacity.

16. In each of the nine years studied, the mills with the largest annual tonnage ground had lower costs and higher net returns than those with the smallest tonnage for the year. The principal advantage of the large mills in obtaining lower costs per unit appeared to be in reduced unit costs of manufacture and lower selling expenses. Also, in all the years studied, the amount of sugar manufactured per ton of cane ground and the percentage of the available sucrose recovered as raw sugar were greater for the large-capacity than for the small-capacity mills.

17. In all of the years studied, there was a general tendency for the mills with relatively high average recovery per ton of cane ground to produce raw sugar at a lower cost per pound than the mills with relatively low yields of sugar manufactured per ton of cane ground. The most important factor causing variation in the yield of sugar per ton of cane ground and in the resulting net incomes was the higher rate of extraction obtained by the larger mills.

18. There appeared to be important geographic differences in the operating conditions in different parts of the Louisiana area where sugar mills are located. In most of the years studied, costs per unit were lower in the Teche area than in the Mississippi region. These geographic differences in costs were indicated to be due at least partly to the higher recovery rates and the larger average volume of business of the mills in the Teche area.

APPENDIX

TABLE I. Costs and Returns from the Operation of Sugar Mills in Louisiana Showing Average Per Ton of Cane Ground for the Years 1937-1945

Items of cost and returns	Average per ton of cane								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	$	$	$	$	$	$	$	$	$
General overhead									
Labor	.15	.10	.17	.20	.18	.16	.15	.16	.14
Materials	.02	.01	.02	.02	.01	.01	.01	.01	.01
Taxes	.07	.06	.06	.09	.08	.06	.06	.07	.07
Insurance	.07	.07	.08	.10	.11	.08	.08	.07	.07
Depreciation	.16	.16	.20	.32	.24	.22	.20	.22	.22
Other	.06	.04	.03	.06	.05	.06	.05	.06	.05
Total	.53	.44	.56	.79	.67	.59	.55	.59	.56
Procurement of cane									
Labor	.04	.04	.06	.05	.11	.09	.07	.08	.04
Transportation	.31	.28	.33	.30	.28	.32	.41	.39	.43
Cane purchased	2.95	2.73	2.79	2.76	3.52	4.34	4.27	4.11	4.15
Other	.12	.07	.01	.03	.21	.07	*	.07	.04
Total	3.42	3.12	3.19	3.14	4.12	4.82	4.75	4.65	4.66
Manufacture of sugar									
Labor	.36	.40	.35	.45	.57	.50	.61	.66	.65
Fuel	.15	.10	.09	.12	.10	.14	.14	.14	.10
Lime, sulphur, etc.	.02	.02	.02	.02	.02	.18	.19	.02	...
Bags and twine	.06	.06	.07	.09	.07	.09	.12	.11	.09
Laboratory sup.	.02	.01	.01	.01	*	.01	.01	*	...
Other supplies	.03	.04	.03	.05	.04	.10	.11	.07	.07
Repairs—labor	.08	.08	.15	.22	.08	*	.01	.19	.19
Repairs—material	.18	.14	.16	.24	.12	.06	.06	.25	.29
Other	.04	.03	.04	.04	.10	.06	.06	.04	.07
Total	.94	.88	.92	1.24	1.10	1.14	1.31	1.48	1.46
Selling									
Commission	.07	.06	.06	.04	.04	.04	.05	.05	.02
Weighing and gauging	.01	.01	.01	.01	.01	.01	.01	.01	.01
Storage	*	...	.02	.02	*	*	.01	*	.01
Freight and drayage	.16	.15	.16	.10	.08	.09	.12	.09	.06
Other	*	.03	.01	.01	.02	.01	.01	.01	*
Total	.24	.25	.26	.18	.15	.15	.20	.16	.10
Interest	.26	.23	.22	.39	.32	.27	.26	.27	.26
Total cost	5.39	4.92	5.15	5.74	6.36	6.97	7.07	7.15	7.04
Miscellaneous credits	.48	.32	.45	.57	1.75	1.35	1.52	1.32	1.59
Net cost	4.91	4.60	4.70	5.17	4.61	5.62	5.55	5.83	5.45
Receipts									
Raw sugar	4.90	4.64	5.02	4.82	5.31	6.19	6.00	5.70	5.76
Miscellaneous receipts									
Other sugar	.10	.02	.05	.02	.52	*	.07	.01	.03
Syrup	.02	.04	.02	.07	.12	.05	*	.01	...
Molasses	.28	.19	.31	.39	.99	1.20	1.36	1.25	1.23
Other	.08	.07	.07	.09	.12	.10	.09	.05	.10
CCC Assistance	...	...	...	...	...	...	...	...	.23
Total misc.	.48	.32	.45	.57	1.75	1.35	1.52	1.32	1.59
Total receipts	5.38	4.96	5.47	5.39	7.06	7.54	7.52	7.02	7.35
Operating expense	5.13	4.69	4.93	5.35	6.04	6.70	6.81	6.88	6.78
Net operating income	.25	.27	.54	.04	1.02	.84	.71	.14	.57
Net income	−.01	.04	.32	−.35	.70	.57	.45	−.13	.31
Capital investment	5.16	4.69	4.45	7.89	6.41	5.25	5.12	5.33	5.22
Sugar made—pounds	154.75	170.35	174.49	163.50	167.90	170.64	160.82	152.80	155.70

*Less than $.005.

TABLE II. COSTS AND RETURNS FROM THE OPERATION OF SUGAR MILLS IN LOUISIANA SHOWING AVERAGE PER MILL FOR THE YEARS 1937 THROUGH 1945, INCLUSIVE

Items of cost and returns	Average per mill								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	(Dollars)	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*
General overhead									
Labor	11,075.82	8,552.03	12,423.94	8,708.02	10,995.28	12,566.44	13,247.24	13,499.00	12,414.83
Materials	1,787.79	891.56	1,404.45	888.84	462.23	489.29	915.46	1,252.97	553.39
Taxes	5,234.25	5,234.59	4,421.68	4,121.00	4,846.69	4,886.45	5,466.46	6,033.52	6,382.33
Insurance	4,954.63	5,427.47	5,978.91	4,636.26	6,745.61	6,087.38	6,652.17	6,188.89	6,082.32
Depreciation	12,071.65	13,140.67	14,708.11	14,228.15	14,989.84	16,447.73	17,103.45	18,356.47	18,863.45
Other	4,579.54	3,222.53	2,061.14	2,667.97	3,519.12	4,243.76	4,507.50	5,070.27	4,331.80
Total	39,703.68	36,468.85	40,998.23	35,250.24	41,558.77	44,721.05	47,892.28	50,401.12	48,628.12
Procurement of cane									
Labor	2,907.18	3,694.23	4,134.01	2,297.29	6,749.71	7,285.87	6,105.16	6,837.27	3,082.63
Transportation	23,250.29	23,252.65	24,801.94	13,301.57	17,640.31	24,389.26	35,939.10	33,020.35	37,631.51
Cane purchased	223,225.55	226,171.68	206,303.29	122,779.40	219,760.59	331,682.50	372,130.51	349,698.10	361,096.09
Other	8,751.96	5,804.12	1,142.70	1,159.21	13,335.95	5,609.40	221.84	5,779.82	3,640.74
Total	258,134.98	258,922.68	236,381.94	139,537.47	257,486.56	368,967.03	414,396.61	395.335.54	405,450.97
Manufacture of sugar									
Labor	27,253.74	33,504.16	26,201.28	19,922.78	35,554.56	37,801.84	53,623.75	55,965.23	56,952.10
Fuel	11,215.85	8,322.83	6,378.56	5,134.58	5,917.54	6,856.53	10,156.75	12,030.58	8,315.58
Lime, sulphur, etc.	1,239.55	1,596.53	1,526.53	697.87	1,064.22	1,067.89	1,259.47	1,720.56	....
Bags and twine	4,827.49	4,920.68	5,338.07	3,899.92	4,540.07	7,324.18	10,030.21	9,096.25	8,196.35
Laboratory supplies	1,291.11	427.72	409.99	456.18	264.48	246.18	514.85	402.11	....
Other supplies	2,397.38	3,501.38	2,552.09	2,105.92	2,219.88	4,829.23	5,472.72	5,704.51	5,658.04
Repairs—labor	6,464.42	6,211.67	10,836.31	9,865.79	4,729.37	10,623.29	11,859.29	16,538.27	16,229.03
Repairs—material	13,277.86	11,956.95	12,136.56	11,010.10	7,774.13	14,069.25	16,626.98	20,831.23	25,671.54
Other	2,895.39	2,480.42	2,858.80	1,946.71	6,548.04	4,579.60	4,945.63	3,461.55	6,519.40
Total	70,862.79	72,922.34	68,238.19	55,039.85	68,612.29	87,397.99	114,489.65	125,750.29	127,542.04

(Continued on page 27)

TABLE II—Continued

Items of cost and returns	Average per mill								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	(Dollars)	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*	*(Dollars)*
Selling									
Commission	5,229.99	4,669.19	4,205.99	1,866.13	2,767.25	3,343.79	4,727.29	3,913.70	1,842.27
Weighing and gauging	817.34	850.97	974.63	260.74	378.44	529.58	642.95	463.87	660.11
Storage	33.98	....	1,189.77	672.32	172.93	246.97	430.62	144.83	816.93
Freight and drayage	12,322.50	12.686.31	11,839.59	4,629.50	4,989.98	7,084.23	10,674.45	8,094.54	4,914.77
Other	324.43	2,375.83	998.36	516.55	1,149.07	470.56	740.77	1,059.45	378.53
Total	18,728.24	20,582.30	19,208.34	7,945.24	9,466.67	11,675.13	17,216.08	13,676.39	8,612.61
Interest	19,512.64	19,227.14	16,492.84	17,549.65	20,017.98	20,076.42	22,314.95	22,648.84	22,738.82
Total cost	406,942.33	408,123.31	381,319.54	255,322.45	397,142.27	532,837.62	616,309.57	607,812.18	612,972.56
Miscellaneous credits	36,204.36	26,386.23	33,404.10	25,226.64	109,200.83	103,615.64	132,610.12	112,209.49	138,355.39
Net cost	370,737.97	381,737.08	347,915.44	230,095.81	287,941.44	429,221.98	483,699.45	495,602.69	474,617.17
Receipts									
Raw sugar	369,988.97	385,205.18	371,306.53	214,181.31	331,896.60	472,875.27	522,828.14	484,165.85	501,942.17
Miscellaneous receipts									
Other sugars	7,577.25	1,288.58	3,730.27	755.00	32,629.67	252.95	5,768.65	554.78	2,848.74
Syrup	1,733.74	3,355.58	1,524.34	3,217.26	7,336.44	3,543.33	407.39	726.94	....
Molasses	20,805.40	16,022.39	23,031.18	17,243.78	61,734.52	92,058.88	118,791.34	105,994.14	106,645.03
Other	6,087.97	5,719.68	5,118.31	4,010.60	7,500.20	7,760.48	7,642.74	4,933.63	8,820.16
CCC assistance	....	....	....	....	....	....	....	....	20,041.46
Total miscellaneous	36,204.36	26,386.23	33,404.10	25,226.64	109,200.83	103,615.64	132,610.12	112,209.49	138,355.39
Total receipts	406,193.33	411,591.41	404,710.63	239,407.95	441,097.43	576,490.91	655,438.26	596,375.34	640,297.56
Operating expense	387,429.69	388,896.17	364,826.70	237,772.80	377,124.29	512,761.20	593,994.62	585,163.34	590,233.74
Net operating income	18,763.64	22,695.24	39,883.93	1,635.15	63,973.14	63,729.71	61,443.64	11,212.00	50,063.82
Net income	− 749.00	3,468.10	23,391.09	−15,914.50	43,955.16	43,653.29	39,128.69	−11,436.84	27,325.00
Capital investment	390,252.75	389,398.35	329,856.85	350,993.08	400,359.65	401,528.49	446,298.89	452,976.82	454,775.44
Cane ground—mill tons	75,561	83,012	74,028	44,447	62,456	76,491	87,117	84,987	87,095
Sugar made—pounds	11,693,450	14,141,279	12,917,332	7,267,582	10,487,408	13,052,404	14,009,962	12,983,639	13,556,532

TABLE III. COSTS AND RETURNS FROM THE OPERATION OF SUGAR MILLS IN LOUISIANA SHOWING AVERAGE PER 100 POUNDS OF SUGAR MANUFACTURED FOR THE YEARS 1937 THROUGH 1945, INCLUSIVE

Items of cost and returns	Average per 100 pounds of sugar								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	$	$	$	$	$	$	$	$	$
General overhead									
Labor	.09	.06	.10	.12	.11	.10	.09	.10	.09
Materials	.02	.01	.01	.01	.01	*	.01	.01	*
Taxes	.05	.04	.03	.06	.05	.04	.04	.05	.05
Insurance	.04	.04	.05	.06	.06	.05	.05	.05	.05
Depreciation	.10	.09	.11	.20	.14	.12	.12	.14	.14
Other	.04	.02	.02	.04	.03	.03	.03	.04	.03
Total	.34	.26	.32	.49	.40	.34	.34	.39	.36
Procurement of cane									
Labor	.03	.03	.03	.03	.06	.06	.04	.05	.02
Transportation	.20	.16	.19	.18	.17	.19	.26	.26	.28
Cane purchased	1.91	1.60	1.60	1.69	2.10	2.54	2.66	2.69	2.66
Other	.07	.04	.01	.02	.13	.04	*	.05	.03
Total	2.21	1.83	1.83	1.92	2.46	2.83	2.96	3.05	2.99
Manufacture of sugar									
Labor	.23	.24	.20	.27	.34	.29	.38	.43	.42
Fuel	.10	.06	.05	.07	.06	.08	.09	.09	.06
Lime, sulphur, etc.	.01	.01	.01	.01	.01	.11	.12	.01	...
Bags and twine	.04	.04	.04	.05	.04	.05	.07	.07	.06
Laboratory supplies	.01	*	*	.01	*	.01	.01	*	...
Other supplies	.02	.02	.02	.03	.02	.05	.07	.05	.04
Repairs—labor	.06	.04	.09	.14	.05	*	*	.13	.12
Repairs—material	.11	.08	.10	.15	.07	.04	.04	.16	.19
Other	.02	.03	.02	.03	.06	.04	.04	.03	.05
Total	.60	.52	.53	.76	.65	.67	.82	.97	.94
Selling									
Commission	.04	.03	.03	.03	.03	.03	.03	.03	.01
Weighing and gauging	.01	.01	.01	*	*	*	*	*	*
Storage	*	*	.01	.01	*	*	*	*	.01
Freight and drayage	.11	.09	.09	.06	.05	.06	.08	.06	.04
Other	*	.02	.01	.01	.01	*	.01	.01	*
Total	.16	.15	.15	.11	.09	.09	.12	.10	.06
Interest	.17	.13	.13	.24	.19	.15	.16	.17	.17
Total costs	3.48	2.89	2.96	3.52	3.79	4.08	4.40	4.68	4.52
Miscellaneous credits	.31	.19	.26	.35	1.04	.79	.95	.87	1.02
Net cost	3.17	2.70	2.70	3.17	2.75	3.29	3.45	3.81	3.50
Receipts									
Raw sugar	3.16	2.73	2.88	2.95	3.17	3.63	3.73	3.73	3.70
Miscellaneous receipts									
Other sugar	.07	.02	.03	.01	.31	*	.04	*	.02
Syrup	.01	.02	.01	.04	.07	.03	*	.01	...
Molasses	.18	.11	.18	.24	.59	.70	.85	.82	.79
Other	.05	.04	.04	.06	.07	.06	.06	.04	.06
CCC Assistance	...	...	...	...	...	...	...	...	.15
Total misc.	.31	.19	.26	.35	1.04	.79	.95	.87	1.02
Total receipts	3.47	2.92	3.14	3.30	4.21	4.42	4.68	4.60	4.72
Operating expenses	3.31	2.76	2.83	3.28	3.60	3.93	4.24	4.51	4.35
Net operating income	.16	.16	.31	.02	.61	.49	.44	.09	.37
Net income	−.01	.03	.18	−.22	.42	.34	.28	−.08	.20
Capital investment	3.34	2.75	2.55	4.83	3.82	3.08	3.19	3.49	3.35
Cane ground—mill tons	.65	.59	.57	.61	.60	.59	.62	.66	.64

*Less than $.005.

TABLE IV. SUMMARY TABLE SHOWING 3-YEAR AVERAGES, 1937 THROUGH 1945, PER MILL, PER TON OF CANE GROUND AND PER 100 POUNDS OF SUGAR MANUFACTURED, OF COSTS AND RETURNS OF RAW SUGAR MILLS IN LOUISIANA

Item	Average 1937-1939			Average 1940-1942			Average 1943-1945		
	Per mill	Per ton	Per 100 lbs. sugar	Per mill	Per ton ground	Per 100 lbs. sugar	Per mill	Per ton ground	Per 100 lbs. sugar
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
General overhead	39,231.14	.51	.30	40,251.87	.67	.40	48,963.89	.57	.36
Procurement of cane	249,592.46	3.23	1.93	248,857.43	4.13	2.46	405,365.51	4.69	3.00
Manufacture of sugar	70,436.56	.91	.55	69,417.86	1.15	.69	121,883.74	1.41	.90
Selling	19,492.60	.25	.15	9,587.96	.16	.09	13,698.88	.16	.10
Interest	18,205.26	.24	.14	19,150.75	.32	.19	22,543.96	.26	.17
Total costs	396,958.02	5.14	3.07	387,265.87	6.43	3.83	612,455.98	7.09	4.53
Miscellaneous credits	32,052.52	.42	.25	77,410.79	1.28	.76	127,005.01	1.47	.94
Net cost	364,905.50	4.72	2.82	309,855.08	5.15	3.07	485,450.97	5.62	3.59
Receipts from:									
Raw sugar	375,202.95	4.85	2.90	332,256.38	5.52	3.29	503,783.49	5.83	3.72
Other income	32,052.52	.42	.25	77,410.79	1.28	.76	127,005.01	1.47	.94
Total income	407,255.47	5.27	3.15	409,667.17	6.80	4.05	630,788.50	7.30	4.66
Operating expenses	378,752.76	4.90	2.93	368,115.12	6.11	3.64	589,912.02	6.83	4.36
Net operating income	28,502.71	.37	.22	41,552.05	.69	.41	40,876.48	.47	.30
Net income	10,297.45	.13	.08	22,401.30	.37	.22	18,332.52	.21	.13
Capital investment	365,599.18	4.73	2.83	382,986.85	6.36	3.79	450,879.15	5.22	3.33
Tons cane ground	77,235		.60	60,237		.60	86,367		.64
Sugar made–pounds	12,931,273	167.43		10,107,469	167.80		13,531,180	156.67	
Average number mills per year	34.7			35.3			27.7		

TABLE V. Relation between the Capacity of Sugar Mills and the Cost, Per 100 Pounds, of Operating Raw Sugar Mills in Louisiana, 1937 through 1945, Inclusive

Capacity of mills in tons per 24 hours	Average capacity per 24 hours	Number of mills	Costs per 100 pounds of raw sugar					
Range and year			Total cost	General over-head	Procure-ment of cane	Manu-facture of sugar	Selling	Interest
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 1000 tons								
1937	725	6	3.48	.36	2.13	.69	.18	.12
1938	650	8	3.14	.26	1.91	.63	.21	.13
1939	756	9	3.00	.28	1.86	.57	.19	.10
1940	850	6	3.40	.46	1.86	.75	.18	.15
1941	788	8	3.98	.35	2.68	.71	.12	.12
1942	850	5	4.45	.36	3.04	.77	.18	.10
1943	850	5	4.92	.49	3.13	1.01	.19	.10
1944	850	4	4.87	.43	3.06	1.10	.14	.14
1945	650	1	4.44	.38	2.80	1.08	.07	.11
1000 to 1499 tons								
1937	1154	13	3.61	.30	2.30	.66	.18	.17
1938	1173	13	2.90	.24	1.81	.56	.16	.13
1939	1160	18	3.06	.33	1.85	.57	.17	.14
1940	1154	17	3.60	.52	1.90	.83	.11	.24
1941	1198	12	3.93	.38	2.55	.67	.11	.22
1942	1128	11	4.27	.32	2.91	.79	.11	.14
1943	1128	11	4.50	.33	3.00	.92	.13	.12
1944	1169	8	4.95	.46	3.15	1.08	.10	.16
1945	1149	11	4.56	.37	3.01	.94	.07	.17
1500 and over								
1937	1918	11	3.40	.36	2.16	.56	.15	.17
1938	1900	11	2.83	.27	1.83	.47	.12	.14
1939	1847	15	2.88	.32	1.82	.50	.12	.12
1940	3502	15	3.48	.47	1.94	.71	.10	.26
1941	1834	16	3.67	.41	2.36	.64	.07	.19
1942	1878	16	3.96	.35	2.76	.61	.07	.17
1943	1878	16	4.30	.33	2.92	.75	.12	.18
1944	1885	17	4.59	.36	3.02	.93	.10	.18
1945	1808	10	4.50	.35	2.99	.93	.06	.17
Total—all mills								
1937	1348	30	3.48	.34	2.21	.60	.16	.17
1938	1292	32	2.89	.26	1.83	.52	.15	.13
1939	1318	42	2.95	.32	1.83	.52	.15	.13
1940	2033	38	3.52	.49	1.92	.76	.11	.24
1941	1390	36	3.79	.40	2.46	.65	.09	.19
1942	1460	32	4.08	.34	2.83	.67	.09	.15
1943	1460	32	4.40	.34	2.96	.82	.12	.16
1944	1545	29	4.68	.39	3.05	.97	.10	.17
1945	1426	22	4.52	.36	2.99	.94	.06	.17

TABLE VI. RELATION BETWEEN THE CAPACITY OF SUGAR MILLS AND THE INCOME PER 100 POUNDS OF RAW SUGAR MANUFACTURED BY LOUISIANA MILLS, 1937 THROUGH 1945, INCLUSIVE

Capacity of mills in tons per 24 hours	Average capacity per 24 hours	Number of mills	Income per 100 pounds of raw sugar				
Range and year			Total receipts	Receipts from sugar	Other receipts	Net operating income	Net income
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 1000 tons							
1937	725	6	3.41	2.92	.49	.05	−.07
1938	650	8	2.91	2.73	.18	−.10	−.23
1939	756	9	3.17	2.92	.25	.27	.17
1940	850	6	3.45	3.10	.35	.20	.05
1941	788	8	4.32	3.27	1.05	.46	.34
1942	850	5	4.87	3.75	1.12	.52	.42
1943	850	5	4.88	3.70	1.18	.06	−.04
1944	850	4	4.67	3.67	1.00	−.06	−.20
1945	650	1	4.48	3.68	.80	.15	.04
1000 to 1499 tons							
1937	1154	13	3.57	3.26	.31	.13	−.04
1938	1173	13	2.90	2.75	.15	.13	*
1939	1160	18	3.15	2.90	.25	.23	.09
1940	1154	17	3.21	2.90	.31	−.15	−.39
1941	1198	12	4.41	3.51	.90	.70	.48
1942	1128	11	4.60	3.74	.86	.47	.33
1943	1128	11	4.85	3.72	1.13	.47	.35
1944	1169	8	4.67	3.71	.96	−.12	−.28
1945	1149	11	4.68	3.70	.98	.29	.12
1500 and over							
1937	1918	11	3.43	3.15	.28	.20	.03
1938	1900	11	2.92	2.70	.22	.23	.09
1939	1847	15	3.11	2.85	.26	.35	.23
1940	3502	15	3.32	2.95	.37	.10	−.16
1941	1834	16	4.08	2.98	1.10	.60	.41
1942	1878	16	4.28	3.56	.72	.49	.32
1943	1878	16	4.59	3.74	.85	.47	.29
1944	1885	17	4.56	3.74	.82	.15	−.03
1945	1808	10	4.76	3.70	1.06	.43	.26
Total—All mills							
1937	1348	30	3.47	3.16	.31	.16	−.01
1938	1292	32	2.92	2.73	.19	.16	.03
1939	1318	42	3.13	2.87	.26	.31	.18
1940	2033	38	3.30	2.95	.35	.02	−.22
1941	1390	36	4.21	3.17	1.04	.61	.42
1942	1460	32	4.42	3.63	.79	.49	.34
1943	1460	32	4.68	3.73	.95	.44	.28
1944	1545	29	4.60	3.73	.87	.09	−.08
1945	1426	22	4.72	3.70	1.02	.37	.20

*Less than $.005.

TABLE VII. RELATION BETWEEN THE VOLUME OF CANE GROUND AND THE AVERAGE COSTS PER 100 POUNDS OF RAW SUGAR MANUFACTURED BY LOUISIANA MILLS, 1937 THROUGH 1945, INCLUSIVE

Tons of cane ground			Costs per 100 pounds of sugar					
Range and year	Average tons ground	Number of mills	Total cost	General Over-head	Procure-ment of cane	Manu-facture of sugar	Selling	Interest
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 50,000 tons								
1937	38,859	7	3.65	.43	2.18	.73	.16	.15
1938	28,656	6	2.90	.21	1.85	.58	.15	.11
1939	40,289	10	3.08	.30	1.89	.59	.19	.11
1940	34,366	26	3.53	.49	1.92	.77	.13	.22
1941	39,056	14	4.07	.40	2.66	.69	.13	.19
1942	44,162	7	4.35	.39	2.95	.74	.12	.15
1943	46,317	6	4.61	.42	3.03	.90	.14	.12
1944	43,724	6	4.93	.48	3.09	1.07	.13	.16
1945	42,709	2	5.05	.45	3.19	1.18	.07	.16
50,000 to 74,999 tons								
1937	62,816	11	3.55	.28	2.29	.66	.17	.15
1938	58,909	7	3.05	.31	1.83	.58	.21	.12
1939	63,856	12	3.03	.31	1.87	.54	.18	.13
1940	60,483	8	3.55	.47	1.95	.79	.09	.25
1941	63,823	12	3.79	.32	2.54	.65	.09	.19
1942	63,224	10	4.31	.34	2.91	.75	.14	.17
1943	62,869	7	5.00	.40	3.24	1.05	.16	.15
1944	62,533	7	5.04	.44	3.20	1.08	.11	.21
1945	67,379	8	4.40	.37	2.88	.90	.06	.19
75,000 and over								
1937	108,655	12	3.41	.35	2.17	.55	.16	.18
1938	109,058	19	2.85	.25	1.83	.50	.13	.14
1939	97,001	20	2.89	.32	1.80	.51	.13	.13
1940	77,908	4	3.41	.50	1.87	.67	.10	.27
1941	93,575	10	3.63	.46	2.27	.63	.07	.20
1942	100,423	15	3.95	.34	2.77	.63	.06	.15
1943	108,935	19	4.26	.32	2.90	.76	.11	.17
1944	110,285	16	4.56	.36	3.00	.93	.10	.17
1945	107,637	12	4.54	.35	3.03	.94	.06	.16
Total—All mills								
1937	75,561	30	3.48	.34	2.21	.60	.16	.17
1938	83,012	32	2.89	.26	1.83	.52	.15	.13
1939	74,028	42	2.95	.32	1.83	.52	.15	.13
1940	44,447	38	3.52	.49	1.92	.76	.11	.24
1941	62,456	36	3.79	.40	2.46	.65	.09	.19
1942	76,491	32	4.08	.34	2.83	.67	.09	.15
1943	87,117	32	4.40	.34	2.96	.82	.12	.16
1944	84,987	29	4.68	.39	3.05	.97	.10	.17
1945	87,095	22	4.52	.36	2.99	.94	.06	.17

TABLE VIII. RELATION BETWEEN THE VOLUME OF CANE GROUND AND THE INCOME PER 100 POUNDS OF SUGAR MANUFACTURED BY MILLS IN LOUISIANA, 1937 THROUGH 1945, INCLUSIVE

Tons of cane ground	Average tons ground	Number of mills	Income per 100 pounds of sugar				
Range and year			Total receipts	Receipts from sugar	Other receipts	Net operating income	Net income
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 50,000 tons							
1937	38,859	7	3.42	2.95	.47	−.08	−.23
1938	28,656	6	2.88	2.74	.14	.09	−.02
1939	40,289	10	3.14	2.85	.29	.17	.06
1940	34,366	26	3.29	2.95	.34	−.02	−.24
1941	39,056	14	4.23	3.32	.91	.35	.16
1942	44,162	7	4.67	3.78	.89	.47	.32
1943	46,317	6	4.60	3.70	.90	.11	−.01
1944	43,724	6	4.61	3.67	.94	−.16	−.32
1945	42,709	2	4.78	3.69	1.09	−.11	−.27
50,000 to 74,999 tons							
1937	62,816	11	3.56	3.25	.31	.16	.01
1938	58,909	7	2.96	2.80	.16	.03	−.09
1939	63,856	12	3.13	2.87	.26	.23	.10
1940	60,483	8	3.33	2.97	.36	.03	−.22
1941	63,823	12	4.40	3.50	.90	.80	.61
1942	63,224	10	4.58	3.68	.90	.44	.27
1943	62,869	7	5.06	3.73	1.33	.21	.06
1944	62,533	7	4.72	3.72	1.00	−.11	−.32
1945	67,379	8	4.55	3.69	.86	.34	.15
75,000 and over							
1937	108,655	12	3.44	3.16	.28	.21	.03
1938	109,058	19	2.91	2.71	.20	.19	.05
1939	97,001	20	3.13	2.88	.25	.37	.24
1940	77,908	4	3.24	2.91	.33	.10	−.17
1941	93,575	10	4.04	2.81	1.23	.61	.41
1942	100,423	15	4.30	3.57	.73	.51	.36
1943	108,935	19	4.62	3.74	.88	.53	.36
1944	110,285	16	4.56	3.74	.82	.17	*
1945	107,637	12	4.79	3.71	1.08	.41	.25
Total—All mills							
1937	75,561	30	3.47	3.16	.31	.16	−.01
1938	83,012	32	2.91	2.72	.19	.15	.02
1939	74,028	42	3.13	2.87	.26	.31	.18
1940	44,447	38	3.30	2.95	.35	.02	−.22
1941	62,456	36	4.21	3.17	1.04	.61	.42
1942	76,491	32	4.42	3.63	.79	.49	.34
1943	87,117	32	4.68	3.73	.95	.44	.28
1944	84,987	29	4.60	3.73	.87	.09	−.08
1945	87,095	22	4.72	3.70	1.02	.37	.20

*Less than $.005.

TABLE IX. Relation between the Yield of Sugar Obtained Per Ton of Cane and the Average Costs Per 100 Pounds of Sugar Manufactured of Operating Sugar Mills in Louisiana, 1937 through 1945, Inclusive

Pounds of raw sugar per ton of cane	Average pounds manufactured	Number of mills	Costs per 100 pounds of sugar					
Range and year			Total cost	General overhead	Procurement of cane	Manufacture of sugar	Selling	Interest
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 150 pounds								
1937	133.11	8	3.91	.29	2.46	.82	.17	.17
1938	144.77	6	3.32	.27	2.12	.68	.14	.11
1939	137.74	2	3.72	.38	2.15	.70	.32	.17
1940	147.21	4	3.91	.53	2.15	.80	.10	.33
1941	......	0	....	....	....	....	....	....
1942	139.01	4	5.01	.39	3.21	1.00	.29	.12
1943	132.51	8	5.33	.41	3.40	1.14	.21	.17
1944	145.79	16	4.85	.42	3.20	.99	.09	.15
1945	135.04	6	4.83	.35	3.23	1.05	.04	.16
150 to 159.9 pounds								
1937	154.62	13	3.41	.35	2.16	.57	.18	.15
1938	156.40	5	2.99	.25	1.85	.56	.23	.10
1939	......	0	....	....	....	....	....	....
1940	156.76	9	4.06	.57	2.21	.93	.10	.25
1941	157.68	5	4.14	.36	2.67	.73	.18	.20
1942	154.42	4	4.48	.31	2.98	.84	.15	.20
1943	157.03	5	4.33	.35	3.03	.79	.06	.10
1944	156.81	8	4.64	.33	2.95	1.02	.13	.21
1945	155.49	8	4.56	.35	3.01	.96	.06	.18
160 to 169.9 pounds								
1937	162.85	7	3.28	.32	2.11	.55	.13	.17
1938	168.11	6	2.80	.22	1.76	.55	.13	.14
1939	164.40	15	3.10	.32	1.94	.55	.17	.12
1940	165.68	19	3.43	.46	1.88	.79	.09	.21
1941	165.57	18	3.65	.39	2.43	.60	.06	.17
1942	166.97	8	4.13	.34	2.90	.70	.04	.15
1943	165.07	10	4.28	.34	2.90	.77	.11	.16
1944	164.11	4	4.36	.40	2.79	.93	.08	.16
1945	164.86	4	4.26	.36	2.87	.81	.06	.16
170 to 179.9 pounds								
1937	174.70	2	3.61	.41	2.26	.55	.16	.23
1938	174.84	11	2.77	.24	1.77	.45	.18	.13
1939	178.75	15	2.93	.34	1.75	.56	.15	.13
1940	174.13	3	3.17	.38	1.85	.65	.15	.14
1941	174.29	12	3.84	.42	2.42	.70	.10	.20
1942	173.59	9	3.99	.36	2.83	.61	.05	.14
1943	173.78	9	4.16	.32	2.80	.74	.12	.18
1944	172.74	1	4.13	.39	2.81	.56	.12	.25
1945	173.81	3	4.37	.39	2.75	.91	.13	.19
180 pounds and over								
1937	......	0	....	....	....	....	....	....
1938	188.82	4	2.96	.33	1.90	.50	.05	.18
1939	184.78	10	2.75	.27	1.80	.44	.11	.13
1940	181.64	3	3.49	.57	1.83	.54	.20	.35
1941	180.07	1	4.02	.38	2.53	.57	.18	.36
1942	187.79	7	3.80	.33	2.60	.58	.12	.17
1943	......	0	....	....	....	....	....	....
1944	......	0	....	....	....	....	....	....
1945	181.40	1	4.07	.42	2.70	.77	.05	.13
Total—All mills								
1937	154.75	30	3.48	.34	2.21	.60	.16	.17
1938	170.35	32	2.89	.26	1.83	.52	.15	.13
1939	174.49	42	2.95	.32	1.83	.52	.15	.13
1940	163.50	38	3.52	.49	1.92	.76	.11	.24
1941	167.90	36	3.79	.40	2.46	.65	.09	.19
1942	170.64	32	4.08	.34	2.83	.67	.09	.15
1943	160.82	32	4.40	.34	2.96	.82	.12	.16
1944	152.80	29	4.68	.39	3.05	.97	.10	.17
1945	155.70	22	4.52	.36	2.99	.94	.06	.17

TABLE X. RELATION BETWEEN THE YIELD OF SUGAR OBTAINED PER TON OF CANE AND THE INCOME PER 100 POUNDS OF RAW SUGAR MANUFACTURED IN MILLS IN LOUISIANA, 1937 THROUGH 1945, INCLUSIVE

Pounds of raw sugar per ton of cane	Average pounds manufactured	Number of mills	Income per 100 pounds of raw sugar				
Range and year			Total receipts	Receipts from sugar	Other receipts	Net operating income	Net income
			Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Under 150 pounds							
1937	133.11	8	3.72	3.21	.51	– .02	– .19
1938	144.77	6	2.87	2.66	.21	– .34	– .45
1939	137.74	2	3.51	2.99	.52	– .04	– .21
1940	147.21	4	3.50	2.86	.64	– .08	– .41
1941	......	0	....	....	....	....	....
1942	139.01	4	5.35	3.82	1.53	.46	.34
1943	132.51	8	5.42	3.79	1.63	.26	.09
1944	145.79	16	4.67	3.73	.94	– .03	– .18
1945	135.04	6	4.90	3.69	1.21	.23	.07
150 to 159.9 pounds							
1937	154.62	13	3.37	3.13	.24	.11	– .04
1938	156.40	5	2.95	2.57	.38	.06	– .04
1939	......	0	....	....	....	....	....
1940	156.76	9	3.67	3.33	.34	– .14	– .39
1941	157.68	5	4.46	3.24	1.22	.52	.32
1942	154.42	4	4.68	3.65	1.03	.40	.20
1943	157.03	5	4.65	3.68	.97	.42	.32
1944	156.81	8	4.58	3.72	.86	.15	– .06
1945	155.49	8	4.78	3.72	1.06	.40	.22
160 to 169.9 pounds							
1937	162.85	7	3.40	3.12	.28	.29	.12
1938	168.11	6	2.80	2.65	.15	.14	*
1939	164.40	15	3.22	2.91	.31	.24	.12
1940	165.68	19	3.26	2.92	.34	.04	– .17
1941	165.57	18	4.24	3.04	1.20	.76	.59
1942	166.97	8	4.52	3.70	.82	.53	.38
1943	165.07	10	4.54	3.71	.83	.42	.26
1944	164.11	4	4.39	3.71	.68	.19	.03
1945	164.86	4	4.58	3.68	.90	.48	.32
170 to 179.9 pounds							
1937	174.70	2	3.70	3.33	.37	.32	.09
1938	174.84	11	2.91	2.79	.12	.27	.14
1939	178.75	15	3.08	2.84	.24	.28	.15
1940	174.13	3	3.20	2.98	.22	.17	.03
1941	174.29	12	4.08	3.27	.81	.44	.24
1942	173.59	9	4.25	3.58	.67	.40	.26
1943	173.78	9	4.51	3.76	.76	.54	.36
1944	172.74	1	4.39	3.77	.62	.51	.26
1945	173.81	3	4.56	3.74	.82	.38	.19
180 pounds and over							
1937	......	0	....	....	....	....	....
1938	188.82	4	3.03	2.82	.21	.25	.07
1939	184.78	10	3.09	2.88	.21	.47	.34
1940	181.64	3	3.44	3.18	.26	.30	– .05
1941	180.07	1	4.26	3.68	.58	.60	.24
1942	187.79	7	4.21	3.55	.66	.58	.41
1943	......	0	....	....	....	....	....
1944	......	0	....	....	....	....	....
1945	181.40	1	4.34	3.59	.75	.40	.27
Total—All mills							
1937	154.75	30	3.47	3.16	.31	.16	– .01
1938	170.35	32	2.92	2.73	.19	.16	.03
1939	174.49	42	3.13	2.87	.26	.31	.18
1940	163.50	38	3.30	2.95	.35	.02	– .22
1941	167.90	36	4.21	3.17	1.04	.61	.42
1942	170.64	32	4.42	3.62	.80	.49	.34
1943	160.82	32	4.68	3.73	.95	.44	.28
1944	152.80	29	4.60	3.73	.87	.09	– .08
1945	155.70	22	4.72	3.70	1.02	.37	.20

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TABLE XI. Geographic Variations in the Financial Results Obtained from the Operation of Sugar Mills in Louisiana for the Years 1937 through 1945, Inclusive—the Teche Region

Items of cost and returns	Average per 100 pounds of sugar								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	$	$	$	$	$	$	$	$	$
General overhead	.36	.25	.31	.46	.39	.36	.35	.38	.35
Procurement of cane	2.20	1.80	1.82	1.91	2.40	2.88	3.01	3.09	2.95
Manufacture of sugar	.55	.47	.48	.74	.65	.71	.84	1.02	.84
Selling	.17	.15	.14	.11	.08	.10	.15	.11	.09
Interest	.18	.13	.12	.24	.19	.15	.15	.17	.15
Total cost	3.46	2.80	2.87	3.46	3.71	4.20	4.50	4.77	4.38
Miscellaneous credits	.28	.22	.26	.33	1.33	.87	1.06	.92	.92
Net cost	3.18	2.58	2.61	3.13	2.38	3.33	3.44	3.85	3.46
Receipts from									
Raw sugar	3.17	2.71	2.87	3.00	3.00	3.60	3.74	3.75	3.73
Miscellaneous credits	.28	.22	.26	.33	1.33	.87	1.06	.92	.92
Total income	3.45	2.93	3.13	3.33	4.33	4.47	4.80	4.67	4.65
Operating expenses	3.28	2.67	2.75	3.22	3.52	4.05	4.35	4.60	4.23
Net operating income	.17	.26	.38	.11	.81	.42	.45	.07	.42
Net income	−.01	.13	.26	−.13	.62	.27	.30	−.10	.27
Capital investment	3.71	2.79	2.31	4.71	3.74	2.98	3.02	3.34	3.06
Pounds of sugar manufactured per ton of cane	158.16	176.48	177.70	168.10	171.57	176.76	165.00	157.91	161.37

TABLE XII. Geographic Variations in the Financial Results Obtained from the Operation of Sugar Mills in Louisiana for the Years 1937 through 1945, Inclusive—the Mississippi Region

Items of cost and returns	Average per 100 pounds of sugar								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	$	$	$	$	$	$	$	$	$
General overhead	.32	.26	.32	.51	.39	.36	.35	.38	.36
Procurement of cane	2.22	1.85	1.84	1.93	2.40	2.88	3.01	3.09	3.02
Manufacture of sugar	.67	.56	.58	.77	.65	.71	.84	1.02	1.00
Selling	.15	.15	.16	.11	.08	.10	.15	.11	.05
Interest	.14	.14	.14	.24	.19	.15	.15	.17	.18
Total cost	3.50	2.96	3.04	3.56	3.71	4.20	4.50	4.77	4.61
Miscellaneous credits	.35	.16	.26	.36	1.33	.87	1.06	.92	1.08
Net cost	3.15	2.80	2.78	3.20	2.38	3.33	3.44	3.85	3.53
Receipts from									
Raw sugar	3.15	2.73	2.88	2.90	3.00	3.60	3.74	3.75	3.69
Miscellaneous credits	.35	.16	.26	.36	1.33	.87	1.06	.92	1.08
Total income	3.50	2.89	3.14	3.26	4.33	4.47	4.80	4.67	4.77
Operating expenses	3.36	2.82	2.90	3.32	3.52	4.05	4.35	4.60	4.43
Net operating income	.14	.07	.24	−.06	.81	.42	.45	.07	.34
Net income	.00	−.07	.10	−.30	.62	.27	.30	−.10	.16
Capital investment	2.90	2.73	2.84	4.94	3.74	2.98	3.02	3.34	3.55
Pounds of sugar manufactured per ton of cane	150.88	165.62	170.90	159.50	164.55	166.23	156.30	148.63	152.05

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Financial Results of the Operation of Large Sugar Cane Farms in Louisiana For Nine Years, 1937 to 1945

By

J. Norman Efferson, Mildred Cobb, and Felix E. Stanley

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TABLE OF CONTENTS

Page

INTRODUCTION 5
- Method of Procedure 6
- Items of Cost 6
- Measures of Cost and Return 8
- Limitations of the Data 9
- Other Considerations 10

AVERAGE RESULTS FOR THE NINE YEARS 11
- Volume of Business 11
- Net Returns per Farm 12
- Costs and Returns per Acre Grown 14
- Costs and Returns per Ton Sold 16
- Nine-Year Average Costs and Returns 17

FACTORS AFFECTING COSTS AND RETURNS 20
- Size of Farm 22
- Yields per Acre 23
- Efficiency in the Use of Man Labor 25
- Proportion of Cropland Planted to Cane 26
- Geographic Variations 27

SUMMARY 28

APPENDIX 31

LIST OF TABLES

Table — Page

1. Average volume of business and yield per acre for large sugar cane farms in Louisiana, 1937 to 1945 12
2. Average net returns from the production of sugar cane on large farms in Louisiana, 1937 to 1945 13
3. Costs and returns per acre of cane grown on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 15
4. Costs and returns per ton of cane sold on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 17
5. Nine-year average costs and returns for large sugar cane farms in Louisiana, 1937 to 1945, inclusive 18
6. Nine-year average labor costs for large sugar cane farms, Louisiana, 1937 through 1945, inclusive 18

APPENDIX TABLES

Table Page

I. Costs and returns per acre of cane grown for large sugar cane farms in Louisiana, 1937 through 1945, inclusive 31

II. Costs and returns per farm for large sugar cane farms in Louisiana, 1937 through 1945, inclusive 32

III. Costs and returns per ton of cane sold on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 34

IV. Three-year period averages of costs and returns for large sugar cane farms in Louisiana, 1937 through 1945, inclusive 35

V. Relation between the number of acres in cane per farm and costs and returns on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 36

VI. Relation between the number of tons of cane sold per farm and the cost of producing cane on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 37

VII. Relation between the number of tons of cane sold per farm and the income per ton on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 38

VIII. Relation between the number of tons of cane sold per farm and various physical factors related to production costs on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 39

IX. Relation between the yield of cane per acre and the costs of operating large sugar cane farms in Louisiana, 1937 through 1945, inclusive 40

X. Relation between the yield of cane per acre and the income from the operation of large sugar cane farms in Louisiana, 1937 through 1945, inclusive 41

XI. Relation between the yield of cane per acre and various physical factors related to production costs on large sugar cane farms in Louisiana, 1937 through 1945, inclusive 42

XII. Relation between direct labor costs per ton of cane sold and cost of producing cane on large sugar cane farms in Louisiana in 1945 43

XIII. Relation between direct labor costs per ton of cane sold and income on large sugar cane farms in Louisiana in 1945 43

XIV. Relation between direct labor costs per ton of cane sold and various physical factors affecting production costs on large sugar cane farms in Louisiana in 1945 43

XV. Geographic variations in the costs and returns from the operation of large sugar cane farms in Louisiana, average per ton of cane sold, for the years 1937 through 1945, inclusive 44

XVI. Geographic variations in the size of business and operating results of large sugar cane farms in three regions in Louisiana, 1937 through 1945, inclusive 46

Financial Results of the Operation of Large Sugar Cane Farms in Louisiana for Nine Years, 1937 to 1945

J. Norman Efferson, Mildred Cobb, and Felix E. Stanley

INTRODUCTION

Detailed studies of the costs and returns from the operation of large sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station each year since 1937.[1] In each year, the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. Records were collected from 33 large farms in 1937, 35 in 1938, 88 in 1939, 89 in 1940, 76 in 1941, 52 in 1942, 55 in 1943, and 54 in 1944 and in 1945.[2] The acreage of sugar cane on the farms studied amounted to approximately 10 per cent of the total acreage of sugar cane for sugar in the state of Louisiana for each year studied, and a much larger proportion of the acreage planted on the large corporation-type farms in the state; thus the sample secured appears to be large enough to be representative of this segment of the Louisiana sugar cane industry.

Sugar cane is one of the three most important crops grown on farms in Louisiana. The farms on which it is produced may be divided into two general types: one is the "family-sized" type of farm, on which most of the labor is performed by the farm operator and members of his family; the other is the "large-scale" type, on which substantially all of the labor is hired. Economic studies of each of these two phases of the sugar cane industry, as well as the manufacturing phase of the industry, are being conducted by the Louisiana Agricultural Experiment Station. The purpose of this report is to present a summary of the financial results of the operation of the large sugar cane farms in Louisiana for the nine-year period 1937 to 1945, and to make comparisons of significant trends during the period.

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[1] *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana, 1937 and 1938* (Louisiana Agricultural Experiment Station Bulletin No. 315; February, 1940); *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana, 1939, 1940, and 1941* (Louisiana Agricultural Experiment Station Bulletin No. 374; March, 1944); *Costs and Returns of Operating Large Sugar Cane Farms in Louisiana, Crop Year 1942* (Department of Agricultural Economics Mimeographed Circular No. 38; November 1943); *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana in 1945* (Department of Agricultural Economics Mimeographed Circular No. 70; Apr., 1947).

[2] The field schedules for the 1937 and 1938 studies were collected by Roy A. Ballinger; for 1939, 1940, and 1941, by Roy A. Ballinger and Reid M. Grigsby; for 1942, by Roy A. Ballinger and K. E. Ford; for 1943 and 1944, by J. Norman Efferson and E. Carl Jones; and for 1945, by F. E. Stanley.

Method of Procedure

The farms selected for the sample were chosen on the basis of 10 per cent of the total cane for sugar acreage of the state, stratified according to the importance of sugar cane in the various sub-areas of the state. Within this stratification, however, the final selection of individual farms in the sample was determined by the degree of co-operation assured by the managers and bookkeepers and the relative accuracy of the records involved. Thus, the average results for each year and for the nine-year period can be considered somewhat better than the averages for the region as a whole, since the most efficient operators are usually the ones who are the most co-operative and keep the best records.

The field data were collected by making personal visits to farms to obtain the necessary information from their records. All of the farms studied had the services of a full-time bookkeeper and employed an outside C. P. A. accounting firm to make a final audit of the results at the end of each season. The basic data used in this study were obtained from the audited reports of each season's operations plus supplementary information of a more detailed nature from the ledger and journal accounts of the individual farm units.

For the most part, identical farms were studied throughout the nine-year period. From year to year, some farms were dropped from the sample and others added for various reasons, but at least three-fourths of the sample included in the most recent year studied, 1945, were included in each of the nine years.

Items of Cost

The total costs of operating the large sugar cane farms were divided into five main groups with each group subdivided into various items. These groupings were determined largely by the customary practices of the farm managers in keeping their accounts. Since accounting practices varied somewhat between farms, however, it was necessary to make certain adjustments in the accounts of some of the farms in order to fit them into the arrangement used in this study. In some cases, it was necessary to make estimates as to the allocation of cost items under the different headings; these estimates were made in all cases by the manager or some other official of the farm unit. Such allocations affect the distribution of costs between items; they do not affect the total cost of any farm.

General Overhead expenses include all items that were not a part of the direct costs of planting, cultivating, and harvesting sugar cane or other crops. Thus this item of expense includes many costs other than those commonly thought of as overhead costs. The reason for this arrangement is that many of the farms did not keep their records in a form that permitted a more detailed summary or breakdown of these so-called overhead costs than that shown. The labor item under general overhead includes both payment for general supervision and maintenance and for the labor used in all farm work of a general nature such as ditching, repairing machinery and fences, and other similar jobs. Other items under general overhead include feed purchased, oil, gasoline, grease, and other similar farm supplies, taxes, insurance, depreciation, and other miscellaneous costs such as labor transportation, stable expenses, and upkeep of yards and buildings. Most of these items, such as oil, gasoline, and grease, actually were used in direct farm operations in connection with the planting, growing, and harvesting of sugar cane, but because the records were kept in such manner that these and other similar items could not be distributed accurately to the specific operations, all such items of cost were included in general overhead expenses. Also, no attempt was made to allocate taxes, insurance, or depreciation to specific groups of costs.

Planting and Cultivating costs include only the direct cash costs of performing these operations on the sugar cane crop. The most important of these costs is labor. The cost of seed cane does not represent a cash cost, except in a few isolated instances where a small amount of seed was purchased from other growers, since most seed cane planted was obtained from production on the farm. The value of cane used for seed in the fall of the previous year was charged as a cost against the following year's crop, while the value of the cane used for seed in the fall of each year was credited as income for that year. These two items do not balance exactly because of differences in the price and amount of cane planted in the different years. The fertilizer costs include the amount paid for purchased fertilizer applied to the current crop and for seeds used for soil improving crops. Other planting and cultivating costs include expenses for grass and weed control, insect and disease control, and similar items.

Harvesting costs include the direct cash costs incurred in cutting, topping, and stripping the cane and loading and hauling it to the field derricks, at which point the cane is transferred to the control of the mills. Most of these expenses were for labor.

Other Crop expenses include the labor, seed, and fertilizer costs incurred in the production and harvesting of the miscellaneous crops produced on the farm. For the most part, these expenses were incurred in the production of corn and/or soybeans on one-third to one-fourth of the total cropland under the usual three- to four-year rotation, which consists of two or three years in sugar cane and one year in corn and soybeans or soybeans alone.

Interest costs were included as a part of the total costs of operating large sugar cane farms. It was calculated at five per cent of the total value of assets used in the business. Interest actually paid by the various farms for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This approach placed all farms on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. The use of the five per cent rate in computing interest charges was largely arbitrary. The effect of using a different rate can be determined by applying any desired rate to the capital investment.

Measures of Cost and Return

The net cost of producing sugar cane was determined by subtracting miscellaneous credits from the total cost. Miscellaneous credits included the income received by the farm units from sources other than the sale of sugar cane and government payments. This miscellaneous income was received largely from cane used for seed, the sale of crops other than sugar cane, and the sale of livestock and livestock products. The production and sale of these products was, for the most part, merely incidental to the business of producing sugar cane; thus the income from their sale may be regarded as having reduced the cost of producing sugar cane below what it would have been otherwise.

The total income of the farms includes the receipts from the sale of sugar cane and payments received under various governmental assistance programs plus the items accounted for in connection with miscellaneous credits.

Operating expenses include all costs except interest on the capital investment. Net operating income is the difference between total income from all sources and operating expenses. It represents the income available for the payment of interest, dividends, and additions to surplus. Net income is the amount remaining after subtracting interest at the rate of 5 per cent from the net operating income, and represents the net return above all costs including a reasonable charge for the capital invested in the business.

Limitations of the Data

The audited financial reports furnished by the growers contributed greatly to the accuracy of the data. There are several limitations in the financial reports on which this series of studies was based, however, which should be pointed out for a clearer interpretation of the results.

Several of the large sugar cane planting companies included in this study operated more than one farm unit. For 1937 and 1938, the records available for such units were not in sufficient detail so that each farm unit could be studied separately and, as a result, the data for these two earlier years show a much larger average size of farm and volume of business per farm than similar results for the years after 1938. This is due to the fact that the records for multiple-unit operating companies were grouped as one single farm unit in 1937 and 1938. In 1939 and succeeding years, the records were such that each individual farm unit could be studied separately. Thus, the averages per farm as presented for 1937 and 1938 are not comparable with averages for the other years. The average unit costs and returns, however, were not affected by this difference; and unit costs and returns for the entire series of nine years are directly comparable.

Some of the growers' books were kept on a cash instead of an accrual basis. On the cash basis, receipts and expenditures are recorded when the cash is actually paid or received, rather than charging that expense or crediting that receipt to the particular crop year to which it is applicable. This cash basis of farm accounting results in slight differences in costs and returns for any one year, as compared with the accrual basis, although over a long period of years, the result will be the same by either method. For instance, government payments for the various assistance programs usually were received in the spring and summer following the crop year in which they were earned. In the two most recent years studied, government payments were lower in 1944 than in 1945, and some of the records apparently contained 1944 government payments for the 1945 crop year instead of the higher payments which should have accrued to 1945. The result is that government payments probably are understated somewhat for the 1945 crop season. Similar payments for the 1946 season were lower than for 1945; thus, these same records will contain an overstatement of government payments for the 1946 crop season.

In addition, some of the records did not separate labor and materials in each of the several categories of expense. In most of these cases, where the cost of materials was low, all of the costs were charged to labor. For this reason, labor costs were overstated slightly in some of the expense classifications. Also, some of the records did not record the amount and value of cane used for seed. In these cases, since cane used for seed in the fall preceding the crop year was not charged as an expense, and the seed planted in the current year for the next year's crop not credited as a receipt, the over-all financial picture remained approximately the same. This method of bookkeeping, however, results in a slight error when average yields per acre are computed. When the amount of cane used for seed was unknown, the tons of cane sold were used to compute the yield of cane per acre planted. It is believed that this procedure in part of the records analyzed caused the average yield per acre for all farms to be understated to the extent of about 1.5 tons per acre in most years.

The "general overhead" expense item, in many cases, contained items that would have been charged as direct costs had the various farm records been kept in more detail. With more detailed records, "general overhead" most likely would have been lower, and "planting and cultivating" and "harvesting" costs correspondingly higher.

Other Considerations

The method used to compute average interests costs is subject to some limitations but is used in an effort to make interest costs comparable for all farms. The only accurate figure available as to the total assets on the books of most of the farm units studied was the "depreciated assets" item as used for federal and state income tax purposes. Since many of the older farm units have depreciated their assets heavily during the course of time, including some farms with every mule on the place written down to a value of a dollar a head, the capital investment data as used in these studies to compute interest charges is lower than the book value, replacement cost, or sales value of the property. As a result, the interest cost for such farms is much lower than the interest which would have had to be paid if the property were purchased on the open market with the use of borrowed funds.

In interpreting the average operating income before interest and the net income after interest, it should be noted that these two measures of return or profit are the returns *before income taxes*, since no state or federal income taxes are included in any of the cost items. Income taxes were excluded from the items of cost in order to obtain an average cost per farm and per unit of production that would be directly comparable from farm to farm and from year to year. This procedure gives more accurate cost data for comparing mill to mill in any one year or averages over a period of years, but it also overstates the actual profit made by the business and retained by the operator or returned to the stockholders of the farm.

The amount of cane produced by the farms is reported in field tons at the derrick, actual weight. For some analysis purposes, the amount in terms of standard tons is more desirable, but this item was not available for all farms.

AVERAGE RESULTS FOR THE NINE YEARS

A brief summary of the average results for each of the nine years studied is shown in Tables 1 through 5. A more detailed analysis of the final results for each year on a per farm, per acre of cane grown, and per ton of cane sold basis, is presented in Appendix Tables I to XVI.

Volume of Business

The average volume of business for the farms studied each year from 1937 to 1945, including the number of farms, the acreage of cane per farm, the tons of cane sold per farm, and the average yield per acre, is indicated in Table 1. From 1937 through 1942, the volume of business as indicated by the acreage of cane per farm and the tons sold per farm varied widely; this difference was due not to variations in plantings from year to year but to variations in the definition of a farm in the sample, which has been explained previously. From 1943 to 1945, the three most recent years of the study, identical farms, for the most part, were included in the study, and the average acreage

Table 1. Average volume of business and yield per acre for large sugar cane farms in Louisiana, 1937 to 1945.

Year	Number of farms	Average per farm		Tons of cane produced per acre
		Acres of cane grown	Tons of cane sold	
1937	33	1,465	28,806	21.0
1938	35	1,305	28,465	23.3
1939	88	634	13,587	23.4
1940	89	611	8,290	15.1
1941	76	633	11,489	19.9
1942	52	1,035	18,619	19.3
1943	55	970	18,787	20.5
1944	54	943	18,079	20.3
1945	54	971	20,232	21.9

varied from 943 acres of cane per farm in 1944 to 971 acres per farm in 1945, while the tons of cane sold varied from 18,000 to about 20,000 per farm in the same period. Throughout the period of time covered by this series of studies, the acreage of sugar cane in Louisiana has been relatively constant, and most of the variation in total production has been due to differences in yield per acre from year to year because of weather conditions.

Average yields on the farms studied varied from a high point of more than 23 tons per acre in 1938 and 1939 to only 15 tons per acre in 1940. For the nine years studied, the average yield was less than 20 tons per acre in three years, varied from 20 to 21.9 tons in four years, and was more than 22 tons per acre in only two years. Yields for this group of farms were slightly higher than average yields of cane for the state as a whole in most years but followed the same general trend.

Net Returns per Farm

The average investment per farm, the net operating income before interest charges, and the net income after interest on a per farm basis, and the percentage return on investment before interest costs and taxes for each of the nine years are shown in Table 2.

Total assets, which represent the depreciated value of all land, buildings, machinery, and equipment used in the operation of these large sugar cane farms, averaged about $173,000 per farm in 1943 but increased to more than $190,000 per farm in 1945. This trend towards an increased investment to operate the same relative volume of business is due to higher replacement costs during the war years for all items of machinery, equipment, and

Table 2. Average net returns from the production of sugar cane on large farms in Louisiana, 1937 to 1945.

Year	Number of farms	Average per farm			
		Total assets	Net operating income	Net income	Percentage return on assets before taxes*
		Dollars	Dollars	Dollars	Per cent
1937	33	257,987	4,474	— 8,425	1.73
1938	35	233,658	4,155	— 8,368	1.78
1939	88	126,177	9,727	3,418	7.71
1940	89	104,170	— 7,434	—12,644	—12.14
1941	76	132,402	2,225	— 4,395	1.68
1942	52	173,006	19,520	10,869	11.28
1943	55	172,774	23,098	14,459	13.37
1944	54	167,377	20,176	11,807	12.05
1945	54	191,758	33,488	23,900	17.46

*Computed by dividing the net operating income by the total assets. Since the net operating income does not include a deduction for actual interest paid or for computed interest costs, this return overstates the actual return by the amount actually paid as interest on borrowed funds.

building materials and to the addition of new machinery such as the mechanical harvester. This trend is expected to increase at an accelerated rate during the next few years because the shortage of machinery, equipment, and other farm supplies has caused most farm operators to delay the purchase of many essential items that must be obtained to replace worn-out equipment in the near future if they are to continue to operate the same volume of business.

The net operating income, or the excess of receipts over expenses, other than interest and income taxes, varied from a loss of more than $7,000 per farm in 1940 to a gain of about $33,000 per farm in 1945. In four of the nine years, the net operating income was less than $5,000 per farm and in three years of the nine, the net operating income amounted to $20,000 or more per farm.

In terms of the percentage return on the capital investment, this net operating income amounted to a loss of 12 per cent of the capital investment in 1940, a gain of less than 2 per cent in three other years, and a gain of more than 10 per cent in four years. There appeared to be no stability of average earnings in the production of sugar cane on large farms in Louisiana during the nine-year period. They made either reasonably good earnings or unreasonably large losses. These facts indicate the fallacy of attempting to make policy decisions regarding this industry on the basis of results of the previous year only; in attempting to forecast what is likely to happen in the future, there appears to be only one assured factor that in future years conditions will be different from those of past years. These conditions are due to the fact that net returns are determined largely by the average yields obtained, and these yields are in turn determined by weather conditions, which are impossible to forecast, during the growing and harvesting season.

The greatly variable net returns in the production of sugar cane from year to year is indicated more clearly by the difference in average net income, or the excess of receipts over expenses plus a charge of 5 per cent to cover all interest costs. The average net income of the farms studied varied from a loss of more than $12,000 in 1940 to a gain of about $24,000 per farm in 1945. Based on net income, these large farms incurred average net losses in four of the nine years studied, and made average net incomes of more than $10,000 per farm in four of the nine years. In terms of the usual businessman's concept of an "average year," there appear to be very few average years in the production of sugar cane. In the nine-year period 1937 to 1945, the average annual returns were either high or low with only one year, 1939, approaching what the grower would term an "average year."

Costs and Returns per Acre Grown

A summary of the average costs and returns per acre of cane grown for the farms studied from 1937 to 1945 is presented in Table 3. A more detailed outline of the unit costs per acre for each item of expense is presented in Appendix Table I.

Unit costs per acre of sugar cane averaged about $90 in the 1937-39 pre-war period but increased gradually during the war years to reach a peak of more than $130 per acre in 1945. Most of this increase in cost was due to increased expenses for the more important items in general overhead, including machinery, labor, and materials, and increased costs for planting and cultivating because of higher wage rates. Costs for harvesting, including only direct labor and transportation to the derrick, increased from about $20 per acre in the pre-war period to only $22 per acre in 1945; because of relatively high wage rates and an acute shortage of labor, most of these farms mechanized rapidly during the war years and substituted machinery (included in overhead costs) for direct labor in harvesting; thus, direct har-

Table 3. Costs and returns per acre of cane grown on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Items of cost and return	Per acre of cane grown								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	($)	($)	($)	($)	($)	($)	($)	($)	($)
Expenses									
General overhead ..	39.07	36.63	34.33	34.37	35.54	43.01	46.89	54.97	64.96
Planting & cultivating	21.45	20.97	21.12	20.65	20.20	23.75	22.45	25.04	29.51
Harvesting cane	20.54	22.08	19.08	10.93	13.73	14.16	20.69	20.28	21.95
Other crops	....	3.90	4.80	4.24	3.45	3.98	3.27	4.49	5.22
Interest	8.80	9.60	9.95	8.56	10.46	8.36	8.91	8.88	9.87
Total cost	89.86	93.18	89.28	78.75	83.38	93.26	102.21	113.66	131.51
Miscellaneous credits	8.49	9.27	10.69	7.01	8.87	9.52	8.15	10.10	10.25
Net cost	81.37	83.91	78.59	71.74	74.51	83.74	94.06	103.56	121.26
Receipts									
Cane sold	57.02	58.21	63.57	36.29	54.05	77.97	86.08	88.62	95.73
AAA payments	18.60	19.28	20.41	14.68	13.52	16.27	22.89	27.46	50.14
Misc. receipts	8.49	9.27	10.69	7.01	8.87	9.52	8.15	10.10	10.25
Total receipts	84.11	86.76	94.67	57.98	76.44	103.76	117.12	126.18	156.12
Operating expenses	81.06	83.58	79.33	70.19	72.92	84.90	93.30	104.78	121.64
Net operating income	3.05	3.18	15.34	—12.21	3.52	18.86	23.82	21.40	34.48
Net income	—5.75	—6.42	5.39	—20.77	—6.94	10.50	14.91	12.52	24.61
Capital investment	176.10	179.00	199.00	171.05	209.20	167.10	178.12	177.49	197.49
Cane produced	21.03	23.26	23.38	15.14	19.87	19.27	20.47	20.31	21.9
Cane sold	20.00	22.81	21.43	13.57	18.15	17.99	19.37	19.17	20.8

vesting costs show little change, while overhead costs were almost twice as high in 1945 as in 1937.

Miscellaneous credits involved in the operation of these farms, which included income received from the sale of other crops and the value of cane saved for seed, changed little during the nine-year period. This income amounted to about $10 per acre of cane grown in the 1937-39 period and averaged $10 per acre in the most recent year studied, 1945. As a result, the net cost per acre of cane grown, which is the difference between total costs and miscellaneous credits, increased at about the same rate as did total costs per acre. Net costs per acre of cane increased 50 per cent from 1937 to 1945.

Income from cane sales also increased during the period but not as rapidly as did total and net costs. Cane sales accounted for income of about $60 per acre in the 1937-39 period as compared with $95 per acre in 1945. Income from government payments, however, more than doubled during the nine-year period; government payments averaged slightly less than $20 per acre in the pre-war period as compared with $50 per acre in 1945. Thus, the data indicate that costs increased at a more rapid rate than did income from cane sales during the war years but that net earnings were maintained because of increased government payments. It should be kept in mind, however, that these government payments to cane growers were based on a national sugar policy of rigid price controls during the war and subsidies to growers in order to maintain production. Based on the experience in World War I, if there had been no government payments and no price controls on sugar in World War II, it is probable that the gross income of cane growers would have been much higher than it was under the price controls and subsidy programs.

For the entire nine-year period, the average net income per acre of cane grown varied from a loss of more than $20 per acre in 1940 to a gain of about $24 per acre in 1945. Net income averaged less than $6 per acre in five years of the period and averaged more than $10 per acre in four years.

Costs and Returns per Ton Sold

A summary of the average costs and returns per ton of sugar cane sold for the farms studied from 1937 to 1945 is presented in Table 4. A more detailed outline of the unit costs per ton for each item of expense is summarized in Appendix Table III.

Total costs per ton of cane varied from about $4.00 in the 1937-39 pre-war period to more than $6.00 in 1945; net costs per ton also increased about 50 per cent during the nine-year period. Income from cane sales, which is based on the price of raw sugar, which was under O.P.A. price control during most of the period, increased from $3.00 per ton in the pre-war period to about $4.50 per ton in 1943 and remained at that level in 1944 and 1945. Income from cane sales plus government payments changed from slightly less than $4.00 per ton sold in the 1937-39 period to $7.00 per ton in 1945.

These unit returns per ton of cane sold vary slightly from the official average prices reported in some of the years studied; this difference is due to the fact that the official prices are quoted in terms of standard tons, while this analysis is made on the basis of actual field tons as delivered to the derrick. Also, owing to the accounting differences mentioned heretofore, the average government payments in some years vary from those announced for a particular crop season.

The net income per ton of cane sold varied from a high point of $1.18 in 1945 to a loss of more than $1.50 per ton in 1940. The

Table 4. Costs and returns per ton of cane sold on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Items of cost and return	Average per ton cane sold								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	($)	($)	($)	($)	($)	($)	($)	($)	($)
Expenses									
General overhead	1.99	1.68	1.60	2.53	1.96	2.39	2.42	2.87	3.11
Planting & cultivating	1.09	.96	.99	1.52	1.11	1.32	1.16	1.31	1.42
Harvesting cane	1.04	1.01	.89	.80	.76	.79	1.07	1.06	1.06
Other crops	....	.18	.22	.31	.19	.22	.17	.23	.25
Interest	.45	.44	.47	.63	.57	.46	.46	.46	.47
Total cost	4.57	4.27	4.17	5.79	4.59	5.18	5.28	5.93	6.31
Misc. credits	.43	.43	.50	.52	.49	.53	.42	.53	.49
Net cost	4.14	3.84	3.67	5.27	4.10	4.65	4.86	5.40	5.82
Receipts									
Cane sold	2.90	2.67	2.97	2.66	2.98	4.34	4.45	4.62	4.59
AAA Payments	.95	.88	.95	1.08	.74	.90	1.18	1.43	2.41
Misc. receipts	.43	.43	.50	.52	.49	.53	.42	.53	.49
Total receipts	4.28	3.98	4.42	4.26	4.21	5.77	6.05	6.58	7.49
Operating expenses	4.12	3.83	3.70	5.16	4.02	4.72	4.82	5.47	5.84
Net operating income	.16	.15	.72	— .90	.19	1.05	1.23	1.11	1.65
Net income	— .29	— .29	.25	— 1.53	— .38	.59	.77	.65	1.18
Capital investment	8.96	8.21	9.29	12.57	11.52	9.29	9.20	9.26	9.48

net income after interests on a per ton basis indicated losses in 1937, 1938, 1940, and 1941; net incomes per ton of less than $1.00 in 1939, 1942, 1943, and 1944; and a net income of more than $1.00 per ton in only one year, 1945.

Nine-Year Average Costs and Returns

A summary of the average costs, returns, and net profits for all of the farms studied for the entire nine-year period, 1937 to 1945, is shown in Table 5. These data are computed on the basis of a weighted average for the entire period. For the nine years, an average of 60 farms per year were surveyed. These farms had an average volume of business of 864 acres of sugar cane and about 18,000 tons of cane produced per farm, with a nine-year average yield of 20.5 tons of sugar cane per acre.

For this period, the farms studied produced sugar cane at an average cost of $97 per acre, or $5.10 per ton sold. Of this amount, 45 per cent was general and overhead costs, 24 per cent was direct planting and cultivating costs, 18 per cent was for direct harvesting expenses, 4 per cent for costs of growing other crops, and 9 per cent for interest.

Table 5. Nine-year average costs and returns for large sugar cane farms in Louisiana, 1937 to 1945, inclusive.

Item	Nine year average		
	Per farm	Per acre grown	Per ton of cane sold
	($)	($)	($)
General overhead	37,449.81	43.34	2.27
Planting and cultivating	19,705.31	22.81	1.20
Harvesting cane	15,612.56	18.07	.95
Other crops	3,232.91	3.74	.20
Interest	7,986.08	9.24	.48
TOTAL COST	83,986.67	97.20	5.10
Miscellaneous credits	7,903.70	9.15	.48
Net cost	76,082.97	88.05	4.62
Receipts from cane	59,423.85	68.77	3.61
Government payments	19,568.09	22.65	1.19
Other receipts	7,903.70	9.15	.48
TOTAL RECEIPTS	86,895.64	100.57	5.28
Operating expenses	76,000.59	87.96	4.62
Net operating income	10,895.05	12.61	.66
Net income	2,908.97	3.37	.18
Capital investment	158,628.73	183.60	9.64
Cane produced—tons	17,672	20.5	......
Cane sold—tons	16,462	......	......
Acres grown	864	......	......
Average number farms per year	59.5		

On the basis of the type of payment, an average of $2.62 per ton, or 51 per cent of the total costs, was made up of direct payments to hired labor (Table 6). Direct labor costs amounted to $0.85 per ton sold for general overhead costs, $0.75 per ton for

Table 6. Nine-year average labor costs for large sugar cane farms, Louisiana, 1937 through 1945, inclusive.*

Item	Average per farm	Per acre cane grown	Per ton cane sold
	($)	($)	($)
General overhead	13,975.12	16.17	.85
Planting and cultivating	12,297.94	14.23	.75
Harvesting cane	14,945.56	17.30	.91
Other crops	1,866.83	2.16	.11
TOTAL	43,085.45	49.86	2.62

*No figure available for "Other crops" in 1937. "Other crops" figure for 1938 not broken down into unit costs.

planting and cultivating, $0.91 per ton for harvesting, and $0.11 per ton for costs of other crops. These facts indicate that more than one-half of the total costs of producing sugar cane for the nine-year period, 1937-45, were direct labor payment. In addition, there were other indirect labor charges included in the repair of machinery and other similar items.

The average gross income for the period amounted to $100 per acre, or $5.28 per ton of cane sold. Of this amount, $3.61 per ton, or 68 per cent, was income from the sale of sugar cane; $1.19 per ton, or 23 per cent, was government payments; and $0.48 per ton, or 9 per cent, was income from other sources.

The net operating income, or the amount remaining to pay interest, income taxes, dividends, and additions to capital, averaged about $11,000 per farm per year, $12 per acre, or $0.66 per ton of cane sold. After deducting interest charges, the net income averaged about $3,000 per farm, $3.00 per acre, or $0.18 per ton of cane sold.

The average capital investment amounted to almost $160,000 per farm. If it were assumed that every farm owner owned all his farm outright and paid no interest charges on any of the capital, the net operating income would amount to 6.9 per cent per year on the capital investment. From this amount would have to come the actual interest paid on borrowed funds, income taxes, and capital replacements to the extent that depreciation rates on old equipment were not sufficient for replacements, before the remainder could be considered net earnings to the investor. In view of the risky nature of the business, such returns are not high.

In terms of the costs and returns for the production of sugar cane for sugar on large farms in Louisiana, the nine-year period, 1937-45, can be characterized as a period of three favorable years, three unfavorable years, and three very unfavorable years. A summary of the average costs and returns for each of the three-year periods, 1937-39. 1940-42, and 1943-45, is shown in Appendix Table IV. The average net income per ton of cane sold amounted to a loss of $0.08 per ton in the 1937-39 period, a loss of $0.35 per ton in the middle period, 1940-42, and a gain of $0.87 per ton for the most recent three-year period.

Total costs per unit for producing sugar cane increased 20 per cent from the first to the second three-year period and increased 14 per cent from the second to the third three-year period. Total receipts increased 13 per cent from the first to the second period and 40 per cent from the second to the third. The last period, 1943-45, proved to be a relatively profitable period because price increases plus increased governmental payments proved to be enough to offset the increased costs, and relatively good yields were obtained without any disastrous year, such as 1940, occurring.

FACTORS AFFECTING COST AND RETURNS

The unit costs and returns and the profits or losses per farm in the operation of large sugar cane farms in Louisiana are affected by a great number of different factors, some under the control of the management and many beyond control of the individual operators. In this state, the major factors determining the costs and returns from the production of sugar cane on large farms are indicated to be the annual variations in the size of the crop, which is determined more by the weather than by the acreage planted, since the acreage has been relatively stable from year to year; the kind of prevailing weather during the harvesting season and the presence or absence of damaging frosts; the sucrose content per ton of cane harvested, which is determined in the short run by the weather and other factors such as the amount of tops, trash, etc.; and the price received for sugar cane, which is based on the usual cane-purchase contract according to the price of raw sugar. The favorable or unfavorable effect of the first three of these four important factors is dependent, in any one year, on the weather, which is not predictable. The favorable or unfavorable effect of the last factor, the price of sugar cane, is dependent on raw sugar prices, which are established at national and international levels.

Because sugar supplies produced in Louisiana make up only about 7 per cent of normal consumption requirements in the United States, the Louisiana sugar production has little effect on sugar supplies for the nation as a whole; therefore, producers in this state do not have the advantage held by some agricultural areas of a short crop usually being accompanied by a compensating high price. For this reason, historical price trends indicate that a short crop is just as likely to be accompanied by a relatively low price as by a high price.

These factors indicate the great dependence of this phase of the sugar cane industry on factors which cannot be foreseen in advance and which determine to a large extent the relative profits from the production of sugar cane. Actually, the most important factor determining the success or failure of an individual farm operator of a large sugar cane farm in Louisiana is whether or not he was fortunate enough to start in the business at a time when the many uncontrollable factors were favorable to good returns. If he came into the business during a period of relative stability of prices and costs and fairly favorable weather conditions, he made good net returns—large profits if he was a good manager but still a net return even if he was a poor manager. If he came into the business at a time of relatively high costs compared with returns and had a bad year or two at the start because of unfavorable weather conditions and/or losses due to frosts, he sustained net losses. And usually, the better manager he was, the more he lost, on the same basis that during the war years the businessman who followed sound business practices and maintained a rapid inventory turnover earned less than his competitor who was less diligent and who received the advantage of every price increase because he did not have a rapid inventory turnover. On large sugar cane farms, the general tendency for higher earnings to be made in the good years and higher losses in the bad years by the efficient operators as compared with the less efficient ones, appears to hold true as it does in many other types of industries.

The financial results of the Louisiana studies of large sugar cane farms show, however, that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. It follows, then, that there are still other reasons for variations in returns in addition to the major ones listed previously. These factors causing one large farm to have lower costs and higher returns than another in the same area and in the same year are both physical and economic in character. The physical factors include selection of varieties, disease and insect control, methods of planting, cultivating, fertilizing, harvesting, and many others. Since this series of studies has been limited to a statistical analysis of the final results each year, no attempt has been made to study these physical and internal-management problems of the large sugar cane farms, although it is recognized that differences do exist and that these variations cause much of the final difference in costs.

From the annual statistical analysis of large sugar cane farms in Louisiana the economic factors that were found to be important in affecting costs, returns, and net profits are as follows: size of farm, yield per acre, labor efficiency, and proportion of cropland planted to cane.

Size of Farm

The average size of the large sugar cane farms studied in Louisiana for the nine-year period was about 2,500 acres, including about 1,500 acres in cropland and the remainder in swamp or poorly-drained land, woods, building sites, roads, and ditches. Of the total cropland, about 900 acres per farm were planted to sugar cane, 500 acres planted to corn and/or soybeans, and 100 acres in other crops or idle cropland. Of the land planted in sugar cane, the usual proportion was about 40 to 45 per cent in plant cane, 40 to 45 per cent in first-year stubble cane, and 10 to 20 per cent in second-year stubble. An average farm of this size required a total investment in land, buildings, workstock, and equipment, of about $150,000.

Although all of the farms included in the Louisiana series of studies of large sugar cane farms were the corporate-sized units, variations in size did exist even in this group. Some of the farms studied had less than 500 acres in cropland, less than 250 acres in sugar cane, and sold less than 5,000 tons of cane per farm per year. Others had more than 2,000 acres in cropland, more than 1,000 acres in sugar cane, and average annual sales of more than 20,000 tons of sugar cane per farm. The relationship of size of farm to costs and returns for the farms studied from 1937 to 1945 is shown in Appendix Tables V through VIII.

There are many measures that are used commonly to indicate the size of a farm. The most familiar and common one is the total acreage in the entire farm. For Louisiana sugar cane farms, the varying relative amounts of woods and swamp on the different farms make this measure undesirable since two farms of the same total acreage may have widely different amounts of cropland and land in cane. Total cropland also is used occasionally; on the farms studied, varying amounts of idle cropland made the use of this measure questionable. The two best measures of size of business of the large sugar cane farms appeared to be the acreage of sugar cane per farm and the volume of sugar cane sold per farm. The tons of sugar cane sold per farm is probably the best measure of the two since it includes both the acreage and the yield factors. The analysis of size in relation to costs and returns as presented in Appendix Tables V through VIII is based on these two measures.

In contrast to the results from the studies of family-type sugar cane farms in Louisiana, the larger farms in the corporate-type farms studied did not have the lowest unit costs and the highest net returns. In most of the years studied, the group of farms with from 1,000 to 1,500 acres in cropland, with from 500 to 1,000 acres in sugar cane, and selling from 10 to 20 thousand tons of cane annually had lower unit costs and made higher net returns per unit than did the smaller farms with less than 500 acres in sugar cane or the larger sized group with more than 1,000 acres in sugar cane.

For some years, however, this general relationship did not hold true. Although in 6 of the 9 years studied, the moderately large corporate-type farms (500 to 1,000 acres of sugar cane per farm) made greater net returns per unit than the larger or smaller farms, in 3 of the 9 years, the fairly small corporate-type farms, with from 250 to 500 acres in sugar cane, had the highest net returns. The years in which this relationship occurred were relatively unfavorable years for the group as a whole. In general, the tendency appeared to be for the moderately large corporate-type sugar cane farms to make higher earnings in good years and larger losses per unit in bad years than the relatively small farms of this type and to make higher net earnings per unit in good years and lower losses in bad years than were made by the extremely large farms of this type.

On family-sized sugar cane farms, the advantage of better utilization of the available unpaid family labor which otherwise would have been idle is such that the larger the size of the farm, so long as it remained a family-sized unit, the greater were the returns in most years. For the large corporate-type farms, however, this advantage of full utilization of unpaid labor does not exist since all of the labor is hired on an hour basis; therefore, the point of diminishing returns appears to have been reached at a size of about 1,000 acres in cane and 1,500 acres in cropland. The data indicate that increased efficiency on these large farms was obtained with increased size up to this point; but beyond this point, increased size appeared to result in higher costs and lower returns rather than increased efficiency.

Yields per Acre

Farm management studies throughout the United States have shown that within the actual practices of farmers, the higher the crop yields, the higher are the returns from farming. Farms with high yields pay higher returns in depression periods as well as in normal or favorable times. Also, good yields of crops and high production rates for animals are the most important factors in obtaining low costs of production. Farmers with high yields have lower costs per unit and make higher returns per hour of labor and per unit of investment than farmers with lower production efficiency.

For large sugar cane farms in Louisiana, the most important single factor influencing the financial success or failure of the group of farms studied each year was the yield of cane obtained per acre. Stated simply, in any year, the farms with relatively high yields brought greater net returns than did the farms with relatively low yields. The relationship of cane yields to costs and returns on the farms studied for each of the nine years, 1937-1945, is shown in Appendix Tables IX, X, and XI.

Although yields per acre for the area, as a whole, varied from year to year, in each year a part of the farms studied made higher than average yields while some farms had below-average yields. Throughout the period, the farms with the higher yields had lower costs per unit and higher net returns than those with fairly low yields. For 1945, the most recent year studied, the 9 farms having yields of from 16 to 18.9 tons per acre had total costs of $6.99 per ton sold as compared with only $5.10 per ton for the 7 farms obtaining yields of from 25 to 27.9 tons per acre. Even in 1940, when everyone had low yields, the 57 farms having average yields of less than 16 tons per acre had average costs of $6.21 per ton as compared with about $5.00 per ton for the 10 farms obtaining average yields of more than 19 tons per acre. Similar results are indicated for the other years studied, although some minor variations did occur which were due to the small number of farms in some of the groupings.

Variations in yield of cane per acre from year to year are caused primarily by the weather. Differences in yields from farm to farm in the same year, however, are due partly to variations in weather and soils in different parts of the cane area but are caused also by many other factors. It has not been possible to measure in this series of statistical studies of large farms the relative importance of these factors. No doubt, some are beyond the control of the individuals operating the farms, but others are largely under the control of the management. For instance, variations in yield resulting from differences in the application of fertilizer, in the use of cover crops, in the selection of varieties, in the control of cane borers, and in planting and cultivating practices are largely under the control of the farm managers, while differences in soil cannot be controlled by management. It is apparent that a considerable part of the differences in yield from farm to farm in any one year is due to factors under the control of the farm operators. If this is true, producers now obtaining low yields should give serious consideration to ways and means of improving their yields.

In a normal year with a 20 to 22 ton per acre yield for the state, as a whole, managers of large sugar cane farms obtaining an average yield per acre on their entire production of from 1 to 5 tons lower than the state average can expect their unit costs to be about 10 per cent higher than on the farms where the state average yields are obtained; those making an average yield for their entire production of from 1 to 5 tons more per acre than the state average can expect their unit costs to be about 10 per cent lower than the farms obtaining average yields and 20 per cent lower than those on which the yields were below average.

Efficiency in the Use of Man Labor

Efficiency in the use of man labor refers to the amount of productive work accomplished per man on the farm; in general, the more work accomplished per man, the greater are the profits. Relatively high labor efficiency is especially important in periods of high prices or in areas of high labor costs. In such cases, labor must be efficiently used because of the higher costs.

Direct labor costs comprised more than one-half of the total costs of producing sugar cane on the large farms studied from 1937 to 1945. Because labor costs made up such a large part of the total costs on these farms, the efficiency with which labor was used was one of the important factors determining the relative success or failure of the different farms. In order to measure the effect of labor efficiency on costs and returns, a special analysis was made of the results for the most recent year studied, 1945. Because of the nature of this series of studies and the fact that they were limited to a statistical analysis of the final results for each year, no physical measure of labor efficiency was available. Thus, a financial measure of labor efficiency, the direct labor costs per ton of cane sold, was used. The relationship of direct labor costs and returns on the farms studied in 1945 is shown in Appendix Tables XII, XIII, and XIV.

In general, the lower the direct labor costs per ton of cane sold, the lower were the total costs of producing cane and the higher the net income per unit. In 1945, the 23 farms with average direct labor costs of less than $2.00 per ton of cane sold had total costs of only $5.98 per ton and an average net income of $1.27, as compared with total costs of $6.81 per ton and a net income of only $0.85 per ton for the 16 farms that had direct labor costs of $2.50 or more per ton.

Since machinery and equipment costs were included under general overhead expenses, a comparison of total costs with general overhead costs for the three groups of farms in Appendix Table XII leads to several interesting observations. The farms that were able to keep direct labor costs below $2.00 per ton also managed to keep general overhead costs reasonably low. This suggests that these farms were highly mechanized and used both man labor and mechanical equipment in the most efficient manner. The farms on which direct labor costs ranged from $2.00 per ton to $2.49 had the highest general overhead costs of any of the three groups. This suggests that this middle group had developed to a stage which might be called "semi-mechanization," since they still had fairly high labor costs per ton but also had high equipment costs. The third group of farms, those with the highest direct labor costs per ton, had the lowest general overhead costs, indicating that they had a lesser degree of mechanization than the other farms and used more man labor in place of mechanized equipment.

The size of business and labor efficiency appeared to be somewhat interrelated factors on the large sugar cane farms studied. The farms with the lowest labor costs were, on the average, the larger farms. Also, as direct labor costs per ton increased, yield per acre of cane decreased. The yield per acre in this case was at least partly the causal factor since it stands to reason that farms with higher yields of cane were able to utilize labor more efficiently than farms with lower yields.

Proportion of Cropland Planted to Cane

There are very few cases in agriculture where one product is so well adapted to an area and where other agricultural products cannot be produced on a large-scale commercial basis so that the specialized production of that one product justifies complete dependence on it for the cash farm income. For the most part, however, the Louisiana sugar cane area appears to be one of these rare cases.

Although the area appears fairly well adapted from the standpoint of climate and soil conditions to the production of a large number of different farm products, none thus far have become serious competitors of sugar cane. Because of the lack of market outlets for any large volume of certain seasonal truck crops, the abundant rainfall which is desirable for sugar cane but not for most other crops, and the lack of low-cost pasture lands essential to the production of certain commodities such as beef and dairy products, there appear to be few, if any, enterprises which can be used to supplement sugar cane production on a large scale.

The Louisiana sugar cane studies from 1937 to 1945 show that not only on the fairly efficient family-sized farms, but also on the large sugar cane farms, the larger the percentage of the total acreage planted to sugar cane and the smaller the dependence on other sources of income, the lower were the costs of producing cane and the greater were the total profits from the farm business. On the farms studied, the units planting from 60 to 65 per cent of their total cropland in sugar cane usually had lower costs and higher returns from sugar cane and from the entire farm business than those units where less than 60 per cent of the total available land was planted to cane. Because of the nature of the data, specific examples are not available, but the interrelationships are indicated in most of the tables presented in the Appendix.

Geographic Variations

There are sufficient variations in the soil, climate, and other factors affecting the production of sugar cane in Louisiana to produce significant differences in the costs of producing sugar cane in different parts of the region. In an effort to measure some of these variations in costs and returns in different parts of the area, the territory was divided into three regions. One of these, the Lafourche region, included the farms that were situated along Bayou Lafourche in the central part of the Louisiana sugar cane area. The Teche region included all but the farms west of the Atchafalaya river and represents the western side of the cane belt. The Mississippi region included the farms that were located along the Mississippi river on the eastern side of the Louisiana sugar cane area. The average costs, returns, net incomes per unit, and physical characteristics of the farms studied in each of the three areas from 1937 to 1945 are shown in Appendix Tables XV and XVI. It is recognized that conditions vary significantly within each of these regions, but the number of farms studied was not large enough to warrant any further subdivision.

In terms of net returns per unit, the Teche region had a slight advantage over the other two areas for the nine years and the Lafourche area appeared to have averaged somewhat lower net returns over the same period. For the nine years, the Teche region had the highest average net return per unit in four years and tied for high in one other, and was lowest in only one year. The Mississippi region had highest average net returns per unit in three years and tied for high in one other but also had the lowest net returns in three years. The Lafourche area made the highest returns of the three areas in only one year of the nine and was lowest in five of the nine years.

The farms studied in the Lafourche area averaged somewhat larger in size than the farms in the other two areas and obtained slightly smaller average yields per acre for the entire period; this factor, however, was not consistent year after year since this region had the highest average yields of any of the areas in three of the nine years. The farms in the Teche region were smaller in size, on the average, than the farms in the other two areas, but had a slightly higher percentage of the total cropland in sugar cane. The farms in the Mississippi region were intermediate in size but had slightly higher average yields per acre than the other two regions.

These facts indicate that variations do exist within the Louisiana sugar cane area, that differences do occur in yields, costs, and returns from one area to another in the same year, but that these differences show no trend or central tendency to indicate that one area is far superior to another over a long period of time.

SUMMARY

1. Detailed studies of the costs and returns from the operation of large sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station each year since 1937. This report summarizes the results of these studies for the nine-year period 1937 to 1945.

2. Records were collected from approximately 60 large farms each year. For the nine-year period, the sample studied represented from 10 to 15 per cent of the total acreage of sugar cane for sugar in the state.

3. All statistical and financial data were obtained from the audited statements of the co-operating companies and individuals. Because of variations in bookkeeping practices, it was necessary to make some adjustments in the records of certain farms in order to keep all records on a comparable basis; these allocations affected the distribution of costs between items to some extent but did not affect the total costs of any one farm.

4. The average size of the large sugar cane farms studied for the nine-year period was about 2,500 acres, including 1,500 acres in cropland of which about 900 acres per farm were planted to sugar cane. An average farm of this size required a total in-

vestment in land, buildings, workstock, and equipment of about $150,000.

5. Average yields on the farms studied varied from more than 23 tons per acre in 1938 and 1939 to only 15 tons per acre in 1940. For the nine years studied, the average yield was less than 20 tons per acre in three years, varied from 20 to 21.9 tons in four years, and was more than 22 tons per acre in two years.

6. The average net income from the production of sugar cane on these farms, or the excess of receipts over expenses plus interest charges, varied from a loss of more than $12,000 per farm in 1940 to a gain of $24,000 in 1945. Average net losses were incurred in four of the nine years studied, and net gains of $12,000 or more per farm were made in four of the nine years.

7. Unit costs averaged about $90 per acre, or $4.00 per ton of cane sold, in the 1937-39 pre-war period but increased gradually during the war years to reach a peak of more than $130 per acre, or $6.00 per ton, in 1945. Expense items increasing most rapidly during the period were direct labor costs and costs for machinery and equipment.

8. Income from cane sales also increased during the period but not at as rapid a rate as did total and net costs. Cane sales accounted for income of about $60 per acre or about $3 per ton in the 1937-39 period to $4.50 per ton in 1943 and remained at that level in 1944 and 1945. Income from governmental payments more than doubled during the nine-year period. Thus, net earnings during the latter years of the war were maintained because of increased governmental payments. It should be kept in mind, however, that these governmental payments to cane growers were based on a national policy of rigid price controls for sugar and subsidies to growers to maintain production; without price controls and subsidies, it is probable that the gross income of cane growers would have been much higher.

9. For the entire nine-year period, the farms studied produced sugar cane at an average cost of $97 per acre, or $5.10 per ton. Of this total, 51 per cent was for direct payments to hired labor. The producers received an average gross income for the period of $100 per acre, or $5.28 per ton. The resulting net income amounted to about $3,000 per farm, $3.00 per acre, or $0.18 per ton of cane sold.

10. If it were assumed that every farm owner owned all his farm outright and paid no interest charges on any of the capital, the net operating income for the nine years would amount to 6.9 per cent on the capital investment. From this amount would have

to come actual interest on borrowed funds, income taxes, and capital replacements to the extent that depreciation rates on old equipment were not sufficient for replacements, before the remainder could be considered net earnings to the operator. In view of the risky nature of this business, such returns are not high.

11. The financial results of this series of studies of large sugar cane farms show that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. The major factors influencing net returns were found to be the size of the farm, the yield of cane per acre, efficiency in the use of man labor, the proportion of the cropland planted to cane, and geographic differences in location of the farms.

12. In contrast to the results from studies of family-type sugar cane farms, the larger units of the corporate-type farms studied did not have the lowest unit costs and the highest net returns. In general, the tendency appeared to be for the moderately large corporate-type farms to make higher returns in good years and larger losses per unit in bad years than the relatively small farms of this type and to make higher net returns in good years and lower losses in bad years than the extremely large farms of this group.

13. The most important single factor influencing the financial success of the farms studied was the yield of cane obtained per acre. In all nine years, the farms with relatively high yields brought greater net returns than the farms with relatively low yields.

14. In general, the lower the direct labor costs per ton of cane sold, the lower were the total costs of producing cane and the higher the net income per unit. Labor efficiency on the farms studied appeared to be interrelated with the degree of mechanization and the size of the farms.

15. The analysis indicates that on these large sugar cane farms, the larger the percentage of the total acreage planted to cane and the smaller the dependence on other sources of income, the lower were the costs of producing cane and the greater were the total profits from the farm business.

16. A comparison of costs and returns according to geographic variations indicates that differences do occur in yields, costs, and returns from one area to another in any one year but that these variations show no trend or central tendency to indicate that one area is superior to other regions over a long period of time.

APPENDIX

Appendix Table I. Costs and returns per acre of cane grown for large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Items of cost and return	Average per acre of cane grown								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
General overhead									
Labor	$15.65	$13.87	$12.69	$13.49	$13.18	$18.20	$16.51	$19.47	$22.42
Feed purchased	3.57	.48	3.49	2.46	.52	2.54	4.84	5.95	3.38
Materials	7.25	5.54	......	.46	4.61	2.13	8.69	11.50	4.48
Oil, gas, grease	2.11	2.28	3.33	2.66	2.32	2.03	4.30	5.75	6.34
Taxes	2.24	2.44	2.91	3.01	2.30	2.68	2.20	2.23	2.06
Insurance	.67	.74	1.36	.98	1.14	.88	.90	1.16	1.32
Depreciation	5.02	5.67	6.03	5.55	5.24	5.49	6.00	6.87	8.22
Other	2.56	5.61	4.52	5.76	6.23	9.06	3.45	2.04	16.74
TOTAL	39.07	36.63	34.33	34.37	35.54	43.01	46.89	54.97	64.96
Planting, cultivating									
Labor	13.63	12.79	13.05	13.88	12.51	14.86	13.72	15.27	18.26
Seed cane	3.84	5.24	5.03	3.63	3.05	4.51	3.54	3.32	3.60
Fertilizer	2.86	2.79	2.82	3.11	3.11	4.35	5.02	5.81	5.35
Other	1.12	.15	.22	.03	1.53	.03	.17	.64	2.30
TOTAL	21.45	20.97	21.12	20.65	20.20	23.75	22.45	25.04	29.51
Harvesting cane									
Labor	20.33	21.89	18.45	10.44	12.78	13.39	18.27	19.43	21.60
Other	.21	.19	.63	.49	.95	.77	2.42	.85	.35
TOTAL	20.54	22.08	19.08	10.93	13.73	14.16	20.69	20.28	21.95
Other crops									
Labor	Not recorded	Not broken down	3.22	3.15	1.98	2.06	1.89	2.84	3.78
Seed			.70	.56	.58	.55	.88	1.18	.80
Fertilizer			.57	.41	.33	.39	.46	.45	.22
Other			.31	.12	.56	.98	.04	.02	.42
TOTAL		3.90	4.80	4.24	3.45	3.98	3.27	4.49	5.22
Interest	8.80	9.60	9.95	8.56	10.46	8.36	8.91	8.88	9.87
Total cost	89.86	93.18	89.28	78.75	83.38	93.26	102.21	113.66	131.51
Misc. credits	8.49	9.27	10.69	7.01	8.87	9.52	8.15	10.10	10.25
Net cost	81.37	83.91	78.59	71.74	74.51	83.74	94.06	103.56	121.26
Source of receipts									
Cane sold	57.02	58.21	63.57	36.29	54.05	77.97	86.08	88.62	95.73
AAA payments	18.60	19.28	20.41	14.68	13.52	16.27	22.89	27.46	50.14
TOTAL	75.62	77.49	83.98	50.97	67.57	94.24	108.97	116.08	145.87
Misc. receipts									
Cane for seed	†	5.16	5.30	3.97	3.74	4.65	2.88	3.91	3.52
Other crops sold	†	.39	2.52	2.01	3.21	1.93	2.40	3.43	2.75
Livestock products sold	†	.28	.10	.34	.01	.43	.13	.28	.18
Other	†	3.44	2.77	.69	1.91	2.51	2.74	2.48	3.80
TOTAL MISC.	8.49	9.27	10.69	7.01	8.87	9.52	8.15	10.10	10.25
Total receipts	84.11	86.76	94.67	57.98	76.44	103.76	117.12	126.18	156.12
Operating expenses	81.06	83.58	79.33	70.19	72.92	84.90	93.30	104.78	121.64
Net operating income	3.05	3.18	15.34	—12.21	3.52	18.86	23.82	21.40	34.48
Net income	—5.75	—6.42	5.39	—20.77	—6.94	10.50	14.91	12.52	24.61
Capital investment	176.10	179.00	199.00	171.05	209.20	167.10	178.12	177.49	197.49
Cane produced, tons	21.03	23.26	23.38	15.14	19.87	19.27	20.47	20.31	21.90
Cane sold—tons	20.00	22.81	21.43	13.57	18.15	17.99	19.37	19.17	20.80

†The figure for Miscellaneous receipts in 1937 was not broken down into units.

Appendix Table II. Costs and returns per farm for large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Items of cost and return	Average per farm								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
General overhead									
Labor	$ 22,922.93	$ 18,098.01	$ 8,043.18	$ 8,212.64	$ 8,344.21	$ 18,838.37	$ 16,016.83	$ 18,364.15	$ 21,772.33
Feed purchased	5,227.82	624.42	2,215.13	1,499.90	326.29	2,627.36	4,692.87	5,608.79	3,286.15
Materials	10,623.11	7,234.03	*	281.61	2,915.35	2,210.03	8,431.69	10,839.37	4,346.83
Oil, gas, grease	3,097.68	2,972.97	2,112.03	1,616.91	1,471.68	2,107.67	4,166.99	5,426.29	6,162.44
Taxes	3,281.71	3,188.83	1,843.42	1,835.47	1,458.60	2,770.52	2,137.53	2,105.39	1,995.94
Insurance	980.70	970.91	863.17	594.27	719.50	905.95	873.94	1,094.67	1,282.26
Depreciation	7,359.11	7,392.27	3,825.01	3,381.04	3,319.59	5,681.50	5,819.53	6,475.39	7,982.48
Other	3,757.59	7,322.48	2,864.90	3,509.88	3,945.22	9,377.90	3,344.47	1,926.99	16,249.89
TOTAL	57,250.65	47,803.92	21,766.84	20,931.72	22,500.44	44,519.30	45,483.85	51,841.04	63,078.32
Planting and cultivating									
Labor	19,954.16	16,693.47	8,273.61	8,452.27	7,921.27	15,383.49	13,312.99	14,393.54	17,725.66
Seed cane	5,628.33	6,838.47	3,186.33	2,211.71	1,931.45	4,672.36	3,438.37	3,128.87	3,499.04
Fertilizer	4,192.45	3,641.39	1,790.86	1,891.75	1,965.96	4,499.91	4,869.46	5,482.53	5,190.04
Other	1,635.63	190.83	136.67	17.33	968.09	31.12	160.64	605.33	2,240.84
TOTAL	31,410.57	27,364.16	13,387.47	12,573.06	12,786.77	24,586.88	21,781.46	23,610.27	28,655.58
Harvesting cane									
Labor	29,781.16	28,577.45	11,699.12	6,357.38	8,092.50	13,860.83	17,723.22	18,318.73	20,976.32
Other	309.69	241.83	397.68	300.87	599.72	793.27	2,342.60	801.38	335.42
TOTAL	30,090.85	28,819.28	12,096.80	6,658.25	8,692.22	14,654.10	20,065.82	19,120.11	21,311.74
Other crops									
Labor	Not	Not	2,043.60	1,919.05	1,254.58	2,134.92	1,833.32	2,682.89	3,665.12
Seed	Re-	bro-	440.84	342.40	366.53	562.33	850.46	1,109.43	777.29
Fertilizer	cor-	ken	362.90	251.82	205.84	401.28	447.44	421.32	210.52
Other	ded	down	198.47	71.92	356.04	1,017.18	42.28	23.17	412.59
TOTAL		5,083.89	3,045.81	2,585.19	2,182.99	4,115.71	3,173.50	4,236.81	5,065.52

*A sum of $453.36 was included in "Oil, gas and grease" column. *(Continued)*

Appendix Table II. (Cont'd.) Costs and returns per farm for large sugar cane farms in Louisiana, 1937 - 1945, inclusive.

Items of cost and return	Average per farm								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
Interest	12,899.36	12,522.55	6,308.89	5,209.60	6,620.10	8,650.31	8,638.71	8,368.83	9,587.90
Total cost	131,651.43	121,593.80	56,605.81	47,957.82	52,782.52	96,526.30	99,143.34	107,177.06	127,699.06
Miscellaneous credits	12,431.72	12,095.59	6,779.08	4,271.97	5,615.58	9,858.39	7,905.56	9,521.06	9,956.73
Net cost	119,219.71	109,498.21	49,826.73	43,685.85	47,166.94	86,667.91	91,237.78	97,656.00	117,742.33
Source of receipts									
Cane sold	83,541.58	75,965.32	40,306.25	22,104.90	34,216.06	80,700.74	83,493.16	83,564.85	92,958.63
AAA payments	27,252.95	25,165.39	12,938.59	8,937.29	8,555.51	16,836.52	22,203.93	25,898.23	48,683.53
TOTAL	110,794.53	101,130.71	53,244.84	31,042.19	42,771.57	97,537.26	105,697.09	109,463.08	141,642.16
Miscellaneous receipts									
Cane for seed	Not	6,730.63	3,358.14	2,422.28	2,364.47	4,810.96	2,797.45	3,690.12	3,413.16
Other crops sold	broken	510.35	1,595.39	1,221.30	2,032.46	2,002.27	2,322.58	3,235.26	2,667.20
Livestock prodults sold	down	365.09	66.09	205.23	11.86	448.54	129.47	261.39	177.15
Other		4,489.52	1,759.46	423.16	1,206.79	2,596.62	2,656.06	2,334.29	3,699.22
TOTAL MISC.	12,431.72	12,095.59	6,779.08	4,271.97	5,615.58	9,858.39	7,905.56	9,521.06	9,956.73
Total receipts	123,226.25	113,226.30	60,023.92	35,314.16	48,387.15	107,395.65	113,602.65	118,984.14	151,598.89
Operating expenses	118,752.07	109,071.25	50,296.92	42,748.22	46,162.42	87,875.99	90,504.63	98,808.23	118,111.16
Net operating income	4,474.18	4,155.05	9,727.00	— 7,434.06	2,224.73	19,519.66	23,098.02	20,175.91	33,487.73
Net income	—8,425.18	—8,367.50	3,418.11	—12,643.66	— 4,395.37	10,869.35	14,459.31	11,807.08	23,899.83
Capital investment	257,987.12	233,657.64	126,177.22	104,169.68	132,402.05	173,006.25	172,774.23	167,376.53	191,758.09
Cane produced—tons	30,809	30,359	14,820	9,250	12,578	19,949	19,853	19,148	21,224
Cane sold—tons	28,806	28,465	13,587	8,290	11,489	18,619	18,787	18,079	20,232
Cane grown—acres	1,465	1,305	634	611	633	1,035	970	943	971

Appendix Table III. Costs and returns per ton of cane sold on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Items of cost and return	Average per ton of cane sold								
	1937	1938	1939	1940	1941	1942	1943	1944	1945
	($)	($)	($)	($)	($)	($)	($)	($)	($)
General overhead									
Labor	.80	.64	.59	.99	.73	1.01	.85	1.02	1.08
Feed Purchased	.18	.02	.16	.18	.03	.14	.25	.31	.16
Materials	.37	.25	......	.03	.25	.12	.45	.60	.22
Oil, gas, grease	.11	.11	.16	.20	.13	.11	.22	.30	.30
Taxes	.11	.11	.14	.22	.13	.15	.11	.11	.10
Insurance	.03	.03	.06	.07	.06	.05	.05	.06	.06
Depreciation	.26	.26	.28	.41	.29	.31	.31	.36	.39
Other	.13	.26	.21	.43	.34	.50	.18	.11	.80
TOTAL	1.99	1.68	1.60	2.53	1.96	2.39	2.42	2.87	3.11
Planting, cultivating									
Labor	.69	.58	.61	1.02	.69	.83	.71	.80	.88
Seed cane	.19	.24	.24	.27	.17	.25	.18	.17	.17
Fertilizer	.15	.13	.13	.23	.17	.24	.26	.30	.26
Other	.06	.01	.01	.00	.08	.00	.01	.04	.11
TOTAL	1.09	.96	.99	1.52	1.11	1.32	1.16	1.31	1.42
Harvesting cane									
Labor	1.03	1.00	.86	.76	.71	.75	.94	1.01	1.04
Other	.01	.01	.03	.04	.05	.04	.13	.05	.02
TOTAL	1.04	1.01	.89	.80	.76	.79	1.07	1.06	1.06
Other crops									
Labor	Not recorded	Not broken down	.15	.23	.11	.11	.10	.15	.18
Seed			.03	.04	.03	.03	.05	.06	.04
Fertilizer			.03	.03	.02	.02	.02	.02	.01
Other			.01	.01	.03	.06	.00	.00	.02
TOTAL	......	.18	.22	.31	.19	.22	.17	.23	.25
Interest	.45	.44	.47	.63	.57	.46	.46	.46	.47
Total Cost	4.57	4.27	4.17	5.79	4.59	5.18	5.28	5.93	6.31
Misc. credits	.43	.43	.50	.52	.49	.53	.42	.53	.49
Net cost	4.14	3.84	3.67	5.27	4.10	4.65	4.86	5.40	5.82
Source of receipts									
Cane sold	2.90	2.67	2.97	2.66	2.98	4.34	4.45	4.62	4.59
AAA payments	.95	.88	.95	1.08	.74	.90	1.18	1.43	2.41
TOTAL	3.85	3.55	3.92	3.74	3.72	5.24	5.63	6.05	7.00
Misc. receipts									
Cane for seed	†	.24	.25	.29	.21	.26	.15	.20	.17
Other crops sold	†	.02	.12	.15	.18	.11	.12	.18	.13
Livestock products sold	†	.01	.00	.03	.00	.02	.01	.01	.01
Other	†	.16	.13	.05	.10	.14	.14	.14	.18
TOTAL MISC.	.43	.43	.50	.52	.49	.53	.42	.53	.49
Total receipts	4.28	3.98	4.42	4.26	4.21	5.77	6.05	6.58	7.49
Operating expenses	4.12	3.83	3.70	5.16	4.02	4.72	4.82	5.47	5.84
Net operating income	.16	.15	.72	— .90	.19	1.05	1.23	1.11	1.65
Net income	— .29	— .29	.25	—1.53	— .38	.59	.77	.65	1.18
Capital investment	8.96	8.21	9.29	12.57	11.52	9.29	9.20	9.26	9.48

†The figure for Miscellaneous receipts in 1937 was not broken down into units.

Appendix Table IV. Three-year period averages of costs and returns for large sugar cane farms in Louisiana, 1937 to 1945, inclusive.

Item	1937 - 1939			1940 - 1942			1943 - 1945		
	Average			Average			Average		
	Per Farm	Per acre cane grown	Per ton cane sold	Per Farm	Per acre cane grown	Per ton cane sold	Per Farm	Per acre cane grown	Per ton cane sold
	($)	($)	($)	($)	($)	($)	($)	($)	($)
General overhead	35,114.68	36.54	1.74	27,133.45	37.68	2.28	53,418.75	55.53	2.80
Planting & cultivating	20,335.84	21.16	1.01	15,526.79	21.57	1.31	24,664.64	25.64	1.30
Harvesting cane	19,655.07	20.45	.98	9,286.66	12.90	.78	20,165.28	20.96	1.06
Other crops	2,858.77	2.98	.14	2,811.09	3.90	.24	4,152.56	4.32	.22
Interest	9,097.12	9.46	.45	6,528.10	9.07	.55	8,863.75	9.21	.47
Total cost	87,061.48	90.59	4.32	61,286.09	85.12	5.16	111,264.99	115.66	5.85
Miscellaneous credits	9,167.64	9.54	.46	6,081.22	8.45	.51	9,120.29	9.48	.48
Net cost	77,893.84	81.05	3.86	55,204.87	76.67	4.65	102,144.70	106.18	5.37
Receipts from cane	57,452.61	59.78	2.85	40,387.99	56.09	3.40	86,652.71	90.08	4.55
Government payments	18,709.82	19.47	.93	10,696.49	14.86	.90	32,200.19	33.47	1.69
Other receipts	9,167.64	9.54	.46	6,081.22	8.45	.51	9,120.29	9.48	.48
Total receipts	85,330.07	88.79	4.24	57,165.69	79.40	4.81	127,973.19	133.03	6.72
Operating expenses	77,964.36	81.13	3.87	54,757.99	76.05	4.61	102,401.23	106.45	5.38
Net operating income	7,365.71	7.66	.37	2,407.70	3.35	.20	25,571.96	26.58	1.34
Net income	— 1,731.41	— 1.80	— .08	— 4,120.40	— 5.72	— .35	16,708.20	17.37	.87
Capital investment	178,174.29	185.40	8.84	130,571.32	181.35	10.99	177,275.18	184.28	9.32
Cane produced—tons	21,689	22.6	....	12,979	18.0	....	20,074	20.9	....
Cane sold—tons	20,145	21.0	....	11,885	16.5	....	19,031	19.8	....
Cane grown—acres	961	....	....	720	....	....	962	....	....
Average number farms per year	52			72			54		

Appendix Table V. Relation between the number of acres in cane per farm and costs and returns on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Acres in cane	Number of farms	Per ton of cane sold				Tons of cane sold	Yield per acre in tons*	Per cent of cultivated area in cane
		Total Cost	Total Receipts	Net operating income	Net Income			
1937—Under 250....	1	4.14	4.32	.53	.18	5,737	25.5	75.9
250 to 499....	2	5.08	4.14	— .53	— .94	4,588	16.5	61.1
500 to 749....	10	4.24	4.17	.28	— .07	13,278	24.1	54.8
750 to 999....	4	4.50	4.00	— .03	— .50	17,045	20.8	68.4
1000 & over..	16	4.63	4.32	.15	— .31	45,919	20.6	64.4
All farms......	33	4.57	4.28	.16	— .29	28,806	21.0	63.3
1938—Under 250....	1	3.65	3.77	.36	.12	6,112	28.1	64.6
250 to 499....	5	3.88	3.95	.42	.07	9,938	27.1	60.3
500 to 749....	7	3.90	4.03	.47	.13	12,871	25.0	59.8
750 to 999....	4	4.23	4.18	.45	— .05	18,087	24.6	60.5
1000 & over..	18	4.35	3.96	.06	— .39	43,225	22.7	62.7
All farms......	35	4.27	3.98	.15	— .29	28,465	23.3	62.2
1939—Under 250....	15	4.38	4.30	.47	— .08	4,360	23.8	47.6
250 to 499....	33	4.04	4.47	.85	.43	8,487	22.8	56.3
500 to 749....	23	4.02	4.22	.43	.20	12,757	23.4	57.7
750 to 999....	6	4.38	3.96	.03	— .42	18,752	24.2	55.9
1000 & over..	11	4.25	4.64	.84	.39	40,386	22.9	56.7
All farms......	88	4.17	4.42	.72	.25	13,587	23.2	56.2
1940—Under 250....	13	6.65	4.69	—1.19	—1.96	2,361	14.9	50.7
250 to 499....	35	5.37	4.13	— .69	—1.24	5,461	15.3	58.6
500 to 749....	26	5.74	4.28	— .85	—1.46	8,343	15.2	61.5
750 to 999....	6	5.77	4.35	— .88	—1.42	9,935	13.8	61.3
1000 & over..	9	6.04	4.26	—1.07	—1.78	26,604	15.3	58.8
All farms......	89	5.79	4.26	— .90	—1.53	8,290	15.2	59.1
1941—Under 250....	10	5.75	4.88	— .16	— .87	3,482	20.8	56.3
250 to 499....	24	4.22	4.69	1.00	.47	8,287	21.7	60.9
500 to 749....	16	4.87	5.19	1.03	.32	10,658	19.0	61.7
750 to 999....	16	4.67	3.20	— .91	—1.47	15,663	19.0	63.0
1000 & over..	10	4.45	4.07	.13	— .38	21,833	20.1	61.4
All farms......	76	4.59	4.21	.19	— .38	11,489	19.9	61.6
1942—Under 250....	1	2.77	2.13	— .31	— .64	7,603	13.4	57.0
250 to 499....	16	4.96	6.03	1.57	1.07	6,630	19.8	55.2
500 to 749....	16	4.74	5.82	1.63	1.08	11,466	20.0	63.4
750 to 999....	5	4.94	5.78	1.25	.84	14,891	19.2	59.1
1000 & over..	14	5.42	5.75	.82	.33	42,613	18.9	70.6
All farms......	52	5.18	5.77	1.05	.59	18,619	19.3	66.2
1943—Under 250....	1	5.18	4.84	— .10	— .34	5,640	23.1	65.6
250 to 499....	16	5.17	5.77	.98	.60	7,325	20.2	64.5
500 to 749....	17	4.90	5.81	1.28	.91	12,331	21.4	62.0
750 to 999....	9	4.69	6.06	1.69	1.37	17,218	21.3	65.0
1000 & over..	12	5.62	6.21	1.14	.59	45,486	19.9	67.8
All farms......	55	5.28	6.05	1.23	.77	18,787	20.5	65.8
1944—Under 250....	2	5.10	5.52	.79	.42	5,270	24.3	66.2
250 to 499....	16	5.58	5.86	.62	.28	7,509	20.4	62.8
500 to 749....	18	5.58	6.09	.91	.51	12,182	20.7	64.5
750 to 999....	5	5.67	6.50	1.15	.83	17,848	21.4	64.7
1000 & over..	13	6.21	6.98	1.31	.77	41,312	19.9	65.3
All farms......	54	5.93	6.58	1.11	.65	18,079	20.3	64.8
1945—Under 250....	1	5.92	5.87	— .05	— .33	4,855	20.2	64.5
250 to 499....	15	5.10	6.40	1.30	1.07	7,704	21.6	68.5
500 to 749....	19	5.41	7.19	1.78	1.26	14,617	20.5	63.3
750 to 999....	6	5.61	7.29	1.68	1.25	17,812	22.2	64.8
1000 & over..	13	6.17	7.85	1.68	1.17	48,308	21.3	68.3
All farms......	54	6.31	7.49	1.65	1.18	20,232	21.8	65.5

*The yield per acre figures are based on the total of tons produced rather than the number sold.

Appendix Table VI. Relation between the number of tons of cane sold per farm and the cost of producing cane on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Tons of cane sold	No. of farms	Cost per ton of cane sold					
		Total costs	Gen. over-head	Planting and cul-tivating	Har-vesting	Other crops	Interest
		($)	($)	($)	($)	($)	($)
1937—Under 5,000	1	6.82	2.50	2.76	1.02	......	.54
5,000 to 9,999	2	4.16	1.61	1.04	1.17	......	.34
10,000 to 14,999	10	4.30	1.61	1.16	1.15	......	.38
15,000 to 19,999	4	4.38	1.89	.80	1.27	......	.42
20,000 and over	16	4.63	2.07	1.10	1.00	......	.46
All farms	33	4.57	1.99	1.09	1.04	......	.45
1938—Under 5,000	1	4.53	1.51	.91	1.07	.15	.89
5,000 to 9,999	2	3.91	1.49	.86	1.06	.26	.24
10,000 to 14,999	10	3.85	1.44	.86	1.03	.19	.33
15,000 to 19,999	4	4.17	1.67	1.02	1.00	.11	.37
20,000 and over	18	4.35	1.72	.97	1.01	.18	.47
All farms	35	4.27	1.68	.96	1.01	.18	.44
1939—Under 5,000	13	4.49	1.77	1.04	.94	.14	.60
5,000 to 9,999	30	4.13	1.66	.92	.92	.22	.41
10,000 to 14,999	25	4.00	1.64	.84	.90	.18	.44
15,000 to 19,999	9	3.98	1.39	.86	1.04	.24	.45
20,000 and over	11	4.32	1.60	1.15	.81	.26	.50
All farms	88	4.17	1.60	.99	.89	.23	.46
1940—Under 5,000	28	6.48	2.73	1.71	.88	.42	.74
5,000 to 9,999	45	5.49	2.40	1.39	.85	.31	.54
10,000 to 14,999	10	6.05	2.77	1.34	.92	.27	.75
15,000 to 19,999	2	4.98	1.99	1.46	.93	......	.60
20,000 and over	4	5.96	2.59	1.80	.56	.35	.66
All farms	89	5.79	2.53	1.52	.80	.31	.63
1941—Under 5,000	10	6.07	2.78	1.12	1.11	.28	.78
5,000 to 9,999	24	4.85	1.90	1.13	.80	.23	.79
10,000 to 14,999	20	4.53	2.10	1.12	.70	.11	.50
15,000 to 19,999	15	4.38	1.77	1.15	.72	.25	.49
20,000 and over	7	4.42	1.93	1.03	.77	.15	.54
All farms	76	4.59	1.96	1.11	.76	.19	.57
1942—Under 5,000	2	6.31	3.08	1.36	1.00	.25	.62
5,000 to 9,999	18	5.28	2.19	1.45	.82	.30	.52
10,000 to 14,999	15	4.45	1.98	1.25	.77	.13	.32
15,000 to 19,999	4	4.89	2.02	1.05	1.00	.28	.54
20,000 and over	13	5.41	2.60	1.35	.76	.22	.48
All farms	52	5.18	2.39	1.32	.79	.22	.46
1943—Under 5,000	1	6.55	2.90	1.48	1.51	......	.66
5,000 to 9,999	19	5.23	2.53	1.23	1.02	.10	.35
10,000 to 14,999	14	5.02	2.39	1.04	1.15	.07	.37
15,000 to 19,999	6	4.38	2.16	.87	.92	.11	.32
20,000 and over	15	5.51	2.45	1.22	1.08	.22	.54
All farms	55	5.28	2.42	1.16	1.07	.17	.46
1944—Under 5,000	2	5.90	3.13	.91	1.27	.15	.44
5,000 to 9,999	18	5.64	2.67	1.46	1.05	.14	.32
10,000 to 14,999	14	5.69	2.92	1.21	1.02	.16	.38
15,000 to 19,999	8	5.36	2.56	1.05	1.19	.16	.40
20,000 and over	12	6.22	2.98	1.37	1.03	.30	.54
All farms	54	5.93	2.87	1.31	1.06	.23	.46
1945—Under 5,000	2	7.18	3.34	2.06	1.15	.10	.53
5,000 to 9,999	16	5.46	2.54	1.43	1.05	.20	.24
10,000 to 14,999	13	5.68	2.72	1.23	1.06	.33	.34
15,000 to 19,999	9	6.34	3.01	1.30	1.08	.24	.71
20,000 and over	14	6.61	3.35	1.48	1.04	.24	.50
All farms	54	6.31	3.11	1.42	1.06	.25	.47

Appendix Table VII. Relation between the number of tons of cane sold per farm and the income per ton on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Tons of cane sold	No. of farms	Income per ton of cane sold					
		Total receipts	Cane sales	Government pay'ents	Other receipts	Net opera. income	Net income
		($)	($)	($)	($)	($)	($)
1937—Under 5,000	1	4.78	3.00	1.11	.67	—1.50	—2.04
5,000 to 9,999	2	4.06	2.89	.91	.26	.24	— .10
10,000 to 14,999	10	4.18	2.88	.95	.35	.26	— .12
15,000 to 19,999	4	3.99	2.88	.81	.30	.03	— .39
20,000 and over	16	4.32	2.90	.96	.46	.15	— .31
All farms	33	4.28	2.90	.95	.43	.16	— .29
1938—Under 5,000	1	5.36	2.79	1.01	1.56	1.72	.83
5,000 to 9,999	2	3.83	2.62	.93	.28	.16	— .08
10,000 to 14,999	10	3.95	2.68	.92	.35	.43	.10
15,000 to 19,999	4	4.13	2.60	.89	.64	.33	— .04
20,000 and over	18	3.96	2.68	.87	.41	.08	— .39
All farms	35	3.98	2.67	.88	.43	.15	— .29
1939—Under 5,000	13	4.39	2.99	.98	.42	.50	— .10
5,000 to 9,999	30	4.42	3.07	.95	.40	.70	.29
10,000 to 14,999	25	4.33	2.94	.92	.47	.77	.33
15,000 to 19,999	9	4.02	2.77	.93	.32	.49	.04
20,000 and over	11	4.61	3.00	.98	.63	.79	.29
All farms	88	4.42	2.97	.95	.50	.71	.25
1940—Under 5,000	28	4.37	2.69	1.12	.56	—1.37	—2.11
5,000 to 9,999	45	4.19	2.65	1.06	.48	— .76	—1.30
10,000 to 14,999	10	4.46	2.63	1.21	.62	— .84	—1.59
15,000 to 19,999	2	3.95	2.67	.73	.55	— .43	—1.03
20,000 and over	4	4.25	2.71	1.07	.47	—1.05	—1.71
All farms	89	4.26	2.66	1.08	.52	— .90	—1.53
1941—Under 5,000	10	4.80	3.80	.69	.31	— .49	—1.27
5,000 to 9,999	24	4.63	3.37	.88	.38	.57	— .22
10,000 to 14,999	20	5.27	3.86	.87	.54	1.24	.74
15,000 to 19,999	15	3.15	2.12	.53	.50	— .74	—1.23
20,000 and over	7	3.69	2.40	.74	.55	— .19	— .73
All farms	76	4.21	2.98	.74	.49	.19	— .38
1942—Under 5,000	2	5.91	4.45	.91	.55	.22	— .40
5,000 to 9,999	18	6.07	4.52	1.04	.51	1.31	.79
10,000 to 14,999	15	5.66	4.26	.90	.50	1.53	1.21
15,000 to 19,999	4	5.65	4.44	.84	.37	1.30	.76
20,000 and over	13	5.74	4.30	.88	.56	.81	.33
All farms	52	5.77	4.34	.90	.53	1.05	.59
1943—Under 5,000	1	5.98	3.86	1.70	.42	.09	— .57
5,000 to 9,999	19	5.75	4.53	.97	.25	.87	.52
10,000 to 14,999	14	5.95	4.43	1.17	.35	1.30	.93
15,000 to 19,999	6	5.82	4.42	1.06	.34	1.76	1.44
20,000 and over	15	6.18	4.43	1.25	.50	1.21	.67
All farms	55	6.05	4.45	1.18	.42	1.23	.77
1944—Under 5,000	2	5.97	4.03	1.44	.50	.51	.07
5,000 to 9,999	18	5.75	4.37	1.12	.26	.43	.11
10,000 to 14,999	14	6.21	4.47	1.41	.33	.90	.52
15,000 to 19,999	8	6.28	4.52	1.34	.42	1.32	.92
20,000 and over	12	7.00	4.77	1.54	.69	1.32	.78
All farms	54	6.58	4.62	1.43	.53	1.11	.65
1945—Under 5,000	2	7.02	4.31	2.10	.61	.36	— .17
5,000 to 9,999	16	6.46	4.30	1.94	.22	1.25	1.01
10,000 to 14,999	13	7.32	4.24	2.66	.42	1.98	1.64
15,000 to 19,999	9	7.20	4.07	2.59	.54	1.58	.87
20,000 and over	14	7.81	4.86	2.40	.55	1.69	1.19
All farms	54	7.49	4.59	2.41	.49	1.65	1.18

Appendix Table VIII. Relation between the number of tons of cane sold per farm and various physical factors related to production costs on large sugar cane farms in Louisiana, 1937 through 1945, inclusive

Tons of cane sold	No. of farms	Size of farms, acres			Tons cane produced	Yield cane per acre, tons	% total area cultivated*	% total area in cane*	% cultivated area in cane
		Total acres*	In cultivation	In cane					
1937—Under 5,000	1	1,000	523	343	3,570	10.4	52.3	34.3	65.6
5,000 to 9,999	2	509	396	254	6,323	24.9	77.8	49.9	64.1
10,000 to 14,999	10	1,978	1,129	621	14,376	23.2	57.1	31.4	55.0
15,000 to 19,999	4	2,362	1,167	806	18,046	22.4	49.4	34.1	69.1
20,000 and over	16	9,052	3,693	2,378	49,033	20.6	40.8	26.3	64.4
All farms	33	5,336	2,314	1,465	30,809	21.0	43.4	27.5	63.3
1938—Under 5,000	1	425	400	258	5,109	19.8	94.1	60.7	64.5
5,000 to 9,999	2	551	422	244	6,462	26.5	76.6	44.3	57.8
10,000 to 14,999	10	1,484	877	528	13,746	26.0	59.1	35.6	60.2
15,000 to 19,999	4	3,754	1,402	856	18,854	22.0	37.3	22.8	61.1
20,000 and over	18	7,614	3,212	2,013	46,203	22.9	42.2	26.4	62.8
All farms	35	4,812	2,098	1,305	30,359	23.3	43.6	27.1	62.2
1939—Under 5,000	13	740	424	201	4,243	21.1	57.3	27.2	47.4
5,000 to 9,999	30	987	649	375	8,490	22.6	65.8	38.0	57.8
10,000 to 14,999	25	1,574	967	545	12,977	23.8	61.4	34.6	56.4
15,000 to 19,999	9	2,191	1,403	783	18,924	24.2	64.0	35.7	55.8
20,000 and over	11	5,727	3,412	1,935	45,416	23.5	59.6	33.8	56.7
All farms	88	1,833	1,129	634	14,820	23.4	61.6	34.6	56.2
1940—Under 5,000	28	839	489	281	3,679	13.1	58.3	33.5	57.5
5,000 to 9,999	45	1,580	890	540	8,160	15.1	56.3	34.2	60.7
10,000 to 14,999	10	2,245	1,482	827	13,334	16.1	66.0	36.8	55.8
15,000 to 19,999	2	3,175	1,813	1,117	19,466	17.4	57.1	35.2	61.6
20,000 and over	4	7,508	4,896	2,930	45,188	15.4	65.2	39.0	59.8
All farms	89	1,724	1,031	611	9,250	15.1	59.8	35.4	59.3
1941—Under 5,000	10	597	322	188	3,636	19.3	53.9	31.5	58.4
5,000 to 9,999	24	1,314	807	463	8,662	18.7	61.4	35.2	57.4
10,000 to 14,999	20	1,879	930	632	13,026	20.6	49.5	33.6	68.0
15,000 to 19,999	15	2,755	1,463	915	18,300	20.0	53.1	33.2	62.5
20,000 and over	7	3,572	2,131	1,247	25,240	20.2	59.7	34.9	58.5
All farms	76	1,861	1,027	633	12,578	19.9	55.2	34.0	61.6
1942—Under 5,000	2	618	454	248	4,221	17.0	73.5	40.1	54.6
5,000 to 9,999	18	1,253	711	399	7,714	19.3	56.7	31.8	56.1
10,000 to 14,999	15	2,471	995	658	13,021	19.8	40.3	26.6	66.1
15,000 to 19,999	4	3,381	1,647	917	18,724	20.4	48.7	27.1	55.7
20,000 and over	13	5,221	3,542	2,509	47,680	19.0	67.8	48.1	70.8
All farms	52	2,736	1,563	1,035	19,949	19.3	57.1	37.8	66.2
1943†—Under 5,000	1	....	344	259	4,185	16.2	....	....	75.3
5,000 to 9,999	19	....	624	398	7,747	19.5	....	....	63.8
10,000 to 14,999	14	....	995	625	13,126	21.0	....	....	62.8
15,000 to 19,999	6	....	1,196	780	17,616	22.6	....	....	65.2
20,000 and over	15	....	3,185	2,141	43,405	20.3	....	....	67.2
All farms	55	....	1,474	970	19,853	20.5	....	....	65.8
1944†—Under 5,000	2	....	314	235	5,007	21.3	....	....	74.8
5,000 to 9,999	18	....	649	409	7,860	19.2	....	....	63.0
10,000 to 14,999	14	....	933	622	12,534	20.2	....	....	66.7
15,000 to 19,999	8	....	1,249	794	17,190	21.6	....	....	63.6
20,000 and over	12	....	3,606	2,337	47,461	20.3	....	....	64.8
All farms	54	....	1,456	943	19,148	20.3	....	....	64.8
1945†—Under 5,000	2	....	382	276	4,632	16.8	....	....	72.5
5,000 to 9,999	16	....	571	397	8,054	20.3	....	....	69.5
10,000 to 14,999	13	....	928	571	12,082	22.0	....	....	61.5
15,000 to 19,999	9	....	1,237	790	17,039	21.6	....	....	63.8
20,000 and over	14	....	3,356	2,216	49,402	22.3	....	....	66.0
All farms	54	....	1,483	971	21,224	21.8	....	....	65.5

*Unable to obtain necessary data for years 1943, 1944, and 1945.

†Figures for "tons cane produced" inaccurate owing to inability to secure tonnage figures from all plantations; "tons cane sold" figures were used where no "tons produced" figures were available.

Appendix Table IX. Relation between the yield of cane per acre and the costs of operating large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Yield per acre—tons	Number of farms	Cost per ton of cane sold					
		Total cost	General overhead	Planting and cultivating	Harvesting	Other crops	Interest
		($)	($)	($)	($)	($)	($)
1937—Under 16	2	4.70	1.88	1.41	.63	......	.78
16 to 18.9	6	4.77	2.13	1.13	1.03	......	.48
19 to 21.9	8	4.53	1.79	1.21	1.05	......	.48
22 to 24.9	9	4.89	2.34	1.05	1.07	......	.43
25 to 27.9	6	3.91	1.54	.93	1.08	......	.36
28 & over	2	3.89	1.50	.87	1.18	......	.34
All farms	33	4.57	1.99	1.09	1.04	......	.45
1938—Under 16	....	....	....	....	....	......	......
16 to 18.9	....	....	....	....	....	......	......
19 to 21.9	9	4.68	1.80	1.06	1.05	.16	.61
22 to 24.9	13	4.12	1.64	.93	.96	.20	.39
25 to 27.9	9	4.20	1.68	.91	1.10	.17	.34
28 & over	4	3.86	1.45	.93	.97	.13	.38
All farms	35	4.27	1.68	.96	1.01	.18	.44
1939—Under 16	....	....	....	....	....	......	......
16 to 18.9	8	4.61	1.71	1.17	.97	.15	.61
19 to 21.9	24	4.31	1.60	1.04	.95	.28	.44
22 to 24.9	26	4.24	1.67	.99	.87	.25	.46
25 to 27.9	19	3.86	1.43	1.00	.84	.18	.41
28 & over	11	4.12	1.76	.76	.87	.13	.60
All farms	88	4.17	1.60	.99	.89	.22	.47
1940—Under 16	57	6.21	2.70	1.65	.83	.35	.68
16 to 18.9	22	5.38	2.41	1.42	.72	.27	.56
19 to 21.9	8	5.13	2.22	1.17	.91	.27	.56
22 to 24.9	2	4.28	1.29	1.13	.98	.08	.80
25 to 27.9	0	0	....	....	....	......	......
28 & over	0	0	....	....	....	......	......
All farms	89	5.78	2.52	1.52	.80	.31	.63
1941—Under 16	7	5.87	2.55	1.36	.86	.29	.81
16 to 18.9	17	5.35	2.23	1.15	.80	.41	.76
19 to 21.9	36	4.37	1.87	1.08	.75	.15	.52
22 to 24.9	8	4.52	1.88	1.12	.68	.15	.69
25 to 27.9	8	3.39	1.53	.98	.68	.01	.19
28 & over	0	0	....	....	....	......	......
All farms	76	4.59	1.96	1.11	.76	.19	.57
1942—Under 16	8	6.59	3.06	1.60	.90	.39	.64
16 to 18.9	10	5.48	2.47	1.53	.78	.24	.46
19 to 21.9	17	5.00	2.38	1.22	.72	.20	.48
22 to 24.9	13	4.36	1.99	1.07	.83	.15	.32
25 to 27.9	3	4.67	1.89	1.36	.85	.04	.53
28 & over	1	3.87	1.42	1.36	.68	.24	.17
All farms	52	5.18	2.39	1.32	.79	.22	.46
1943—Under 16	4	5.95	2.43	1.52	1.23	.28	.49
16 to 18.9	13	5.76	2.43	1.44	1.17	.19	.53
19 to 21.9	18	5.18	2.55	1.01	1.03	.16	.43
22 to 24.9	13	5.20	2.28	1.18	1.08	.19	.47
25 to 27.9	5	4.52	2.42	.76	.98	.04	.32
28 & over	2	3.83	2.25	.52	.55	.04	.47
All farms	55	5.28	2.42	1.16	1.07	.17	.46
1944—Under 16	2	5.74	2.42	1.98	1.06	.05	.23
16 to 18.9	14	6.48	3.04	1.64	1.17	.19	.44
19 to 21.9	23	6.08	2.94	1.28	1.05	.29	.52
22 to 24.9	9	5.09	2.55	1.11	.99	.11	.33
25 to 27.9	3	4.82	2.21	.98	.99	.12	.52
28 & over	3	5.44	2.99	.93	1.00	.19	.33
All farms	54	5.93	2.87	1.31	1.06	.23	.46
1945—Under 16	1	8.29	3.98	1.98	1.39	.12	.82
16 to 18.9	9	6.99	3.26	1.82	1.18	.27	.46
19 to 21.9	20	6.52	3.34	1.40	1.15	.23	.40
22 to 24.9	16	6.38	3.14	1.44	.99	.28	.53
25 to 27.9	7	5.10	2.49	1.02	1.00	.17	.42
28 & over	1	4.64	2.18	1.33	.91	.04	.18
All farms	54	6.31	3.11	1.42	1.06	.25	.47

Appendix Table X. Relation between the yield of cane per acre and the income from the operation of large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Yield per acre—tons	Number of farms	Income per ton cane sold: Total receipts	Cane sales	Government payments	Other receipts	Net operating income	Net income
		($)	($)	($)	($)	($)	($)
1937—Under 16	2	4.83	3.04	1.12	.67	.91	.13
16 to 18.9	6	4.24	2.80	.96	.48	— .05	— .53
19 to 21.9	8	4.12	2.89	.92	.31	.07	— .41
22 to 24.9	9	4.27	2.84	.94	.49	— .19	— .62
25 to 27.9	6	4.46	3.12	.95	.39	.91	.55
28 & over	2	4.02	2.87	.87	.28	.47	.13
All farms	33	4.28	2.90	.95	.43	.16	— .29
1938—Under 16	....	....	....	......	......	......	......
16 to 18.9	....	....	....	......	......	......	......
19 to 21.9	9	4.08	2.66	.89	.53	.01	— .60
22 to 24.9	13	3.94	2.68	.88	.38	.21	— .18
25 to 27.9	9	3.98	2.64	.91	.43	.12	— .22
28 & over	4	3.79	2.72	.85	.22	.31	— .07
All farms	35	3.98	2.67	.88	.43	.15	— .29
1939—Under 16	....	....	....	......	......	......	......
16 to 18.9	8	4.62	3.12	1.01	.49	.62	.01
19 to 21.9	24	4.41	2.95	.98	.48	.54	.10
22 to 24.9	26	4.68	3.08	1.02	.58	.90	.44
25 to 27.9	19	4.22	2.88	.86	.48	.77	.36
28 & over	11	4.11	2.82	.89	.40	.59	— .01
All farms	88	4.42	2.97	.95	.50	.72	.25
1940—Under 16	57	4.31	2.67	1.12	.52	—1.22	—1.90
16 to 18.9	22	4.22	2.67	.99	.56	— .60	—1.16
19 to 21.9	8	4.17	2.68	1.16	.33	— .40	— .96
22 to 24.9	2	3.72	2.48	.92	.32	.24	— .56
25 to 27.9	0	....	....	......	......	......	......
28 & over	0	....	....	......	......	......	......
All farms	89	4.26	2.67	1.08	.51	— .89	—1.52
1941—Under 16	7	5.44	3.80	.95	.69	.38	— .43
16 to 18.9	17	2.86	1.49	.71	.66	—1.73	—2.49
19 to 21.9	36	4.08	2.99	.68	.41	.23	— .29
22 to 24.9	8	5.13	3.87	.84	.42	1.30	.61
25 to 27.9	8	5.32	3.87	.91	.54	2.12	1.93
28 & over	....	....	....	......	......	......	......
All farms	76	4.21	2.98	.74	.49	.19	— .38
1942—Under 16	8	6.10	4.53	.97	.60	.15	— .49
16 to 18.9	10	5.80	4.34	.91	.55	.78	.32
19 to 21.9	17	5.70	4.28	.90	.52	1.18	.70
22 to 24.9	13	5.72	4.32	.87	.53	1.68	1.36
25 to 27.9	3	5.49	4.31	.87	.31	1.35	.82
28 & over	1	4.50	3.48	.88	.14	.80	.63
All farms	52	5.77	4.34	.90	.53	1.05	.59
1943—Under 16	4	6.72	5.03	1.10	.59	1.26	.77
16 to 18.9	13	6.23	4.66	1.10	.47	1.00	.47
19 to 21.9	18	5.82	4.21	1.29	.32	1.07	.64
22 to 24.9	13	6.13	4.51	1.08	.54	1.40	.93
25 to 27.9	5	5.85	4.24	1.40	.21	1.65	1.33
28 & over	2	5.25	3.86	1.36	.03	1.89	1.42
All farms	55	6.05	4.45	1.18	.42	1.23	.77
1944—Under 16	2	6.40	4.29	1.73	.38	.89	.66
16 to 18.9	14	6.54	4.72	1.40	.42	.50	06
19 to 21.9	23	6.77	4.74	1.38	.65	1.21	.69
22 to 24.9	9	6.18	4.35	1.45	.38	1.42	1.09
25 to 27.9	3	5.86	4.23	1.63	.00	1.56	1.04
28 & over	3	6.16	4.02	1.92	.22	1.05	.72
All farms	54	6.58	4.62	1.43	.53	1.11	.65
1945—Under 16	1	8.31	4.30	2.70	1.31	.84	.02
16 to 18.9	9	8.24	5.20	2.45	.59	1.71	1.25
19 to 21.9	20	7.18	4.22	2.56	.40	1.06	.66
22 to 24.9	16	7.67	4.86	2.25	.56	1.82	1.29
25 to 27.9	7	6.95	3.88	2.74	.33	2.27	1.85
28 & over	1	5.67	4.17	1.50	......	1.21	1.03
All farms	54	7.49	4.59	2.41	.49	1.65	1.18

Appendix Table XI. Relation between the yield of cane per acre and various physical factors related to production costs on large sugar cane farms in Louisiana, 1937 through 1945, inclusive.

Yield per acre-tons	No. of farms	Size of farms, acres			Tons cane produced	Tons cane sold	% total area cultivated†	% total area in cane†	% cultivated area in cane
		Total acres†	In cultivation	In cane					
1937—Under 16	2	5,150	1,786	1,138	16,905	15,521	22.1	34.7	63.7
16 to 18.9	6	9,987	3,558	2,443	44,011	41,127	24.5	35.6	68.7
19 to 21.9	8	4,008	1,904	1,231	25,032	23,730	30.7	47.5	64.7
22 to 24.9	9	4,854	2,346	1,462	33,381	30,949	30.1	48.3	62.3
25 to 27.9	6	4,242	2,108	1,217	31,194	29,241	28.7	49.7	57.7
28 and over	2	2,326	1,226	541	15,482	14,488	23.3	52.7	44.1
All farms	33	5,336	2,314	1,465	30,809	28,806	27.5	43.4	63.3
1938—Under 16	....	....	....	....	....	....	....	....	....
16 to 18.9	....	....	....	....	....	....	....	....	....
19 to 21.9	9	5,977	2,386	1,496	31,299	29,325	25.0	39.9	62.7
22 to 24.9	13	6,183	2,735	1,715	39,729	37,171	27.7	44.2	62.7
25 to 27.9	9	3,339	1,470	882	22,911	21,514	26.4	44.0	60.0
28 and over	4	1,051	793	498	14,549	13,878	47.4	75.5	62.8
All farms	35	4,812	2,098	1,305	30,359	28,465	27.1	43.6	62.2
1939—Under 16	....	....	....	....	....	....	....	....	....
16 to 18.9	8	1,014	594	322	5,764	5,248	31.8	58.6	54.2
19 to 21.9	24	2.183	1,349	774	16,114	14,555	35.5	61.8	67.4
22 to 24.9	26	2,134	1.223	682	15,625	14,282	32.0	57.3	55.8
25 to 27.9	19	1,573	1,083	636	16,448	15,294	40.4	68.8	58.7
28 and over	11	1,405	893	465	13,870	12,949	33.1	63.6	52.1
All farms	88	1,833	1,129	634	14,820	13,587	34.6	61.6	56.2
1940—Under 16	57	1,557	954	580	7,836	6,956	37.3	61.3	60.8
16 to 18.9	22	2,249	1,326	772	12,982	11,763	34.3	59.0	58.2
19 to 21.9	8	1,752	905	853	9,188	8,426	48.7	51.7	94.3
22 to 24.9	2	886	482	359	8,726	7,541	40.5	54.4	74.5
25 to 27.9	0	....	....	....	....	....	....	....	....
28 and over	0	....	....	....	....	....	....	....	....
All farms	89	1,724	1,031	611	9,250	8,290	35.4	59.8	59.3
1941—Under 16	7	1,460	1,111	762	11,795	10,612	52.2	76.1	68.6
16 to 18.9	17	1,333	850	531	9,456	8,540	39.8	63.8	62.5
19 to 21.9	36	2,332	1,203	726	14,709	13,513	31.1	51.6	60.3
22 to 24.9	8	1,476	1,082	550	12,480	11,430	37.3	73.3	50.8
25 to 27.9	8	1,594	480	397	10,406	9,472	24.9	30.1	82.7
28 and over	0	....	....	....	....	....	....	....	....
All farms	76	1,861	1,027	633	12,578	11,489	34.0	55.2	61.6
1942—Under 16	8	2,800	1,999	1,250	18,626	17,054	44.6	71.4	62.5
16 to 18.9	10	3,198	1,966	1,363	23,754	21,980	42.6	61.5	69.3
19 to 21.9	17	3,212	1,694	1,147	23,321	21,937	35.7	52.7	67.7
22 to 24.9	13	2,163	1,078	703	16,352	15,364	32.5	49.8	65.2
25 to 27.9	3	1,477	790	439	11,478	10,729	29.7	53.5	55.6
28 and over	1	724	419	259	7,319	7,095	35.8	57.9	61.8
All farms	52	2,736	1,563	1,035	19,949	18,619	37.8	57.1	66.2
1943—Under 16	4	....	1,785	1,251	18,753	18,503	....	....	70.1
16 to 18.9	13	....	1,566	1,042	18,595	17,491	....	....	66.5
19 to 21.9	18	....	1,412	941	19,233	18,541	....	....	66.6
22 to 24.9	13	....	1,684	1,072	24,848	22,685	....	....	63.7
25 to 27.9	5	....	818	530	13,733	13,189	....	....	64.8
28 and over	2	....	1,087	653	18,643	18,643	....	....	60.1
All farms	55	....	1,474	970	19,853‡	18,787	....	....	65.8
1944—Under 16	2	....	1,017	723	10,773	10,308	....	....	71.1
16 to 18.9	14	....	1,209	721	12,807	12,021	....	....	59.6
19 to 21.9	23	....	2,001	1,319	26,606	24,876	....	....	65.9
22 to 24.9	9	....	1,028	707	16,473	15,805	....	....	68.8
25 to 27.9	3	....	729	411	10,460	10,460	....	....	56.4
28 and over	3	....	741	487	13,862	13,862	....	....	65.7
All farms	54	....	1,456	943	19,148‡	18,079	....	....	64.8
1945—Under 16	1	....	391	313	4,408	4,289	....	....	80.0
16 to 18.9	9	....	1,111	676	12,084	11,479	....	....	60.9
19 to 21.9	20	....	1,168	742	15,170	14,564	....	....	63.5
22 to 24.9	16	....	2,398	1,603	36,389	34,425	....	....	66.8
25 to 27.9	7	....	1,083	754	19,821	19,187	....	....	69.6
28 and over	1	....	388	289	8,576*	8,576	....	....	74.5
All farms	54	....	1,483	971	21,224‡	20,232	....	....	65.5

†Unable to obtain necessary data for years 1943, 1944, and 1945.

‡Figures for "tons cane produced" inaccurate—in many instances "tons sold" figures had to be substituted for "tons produced" as figures on total tonnage produced for some farms were unavailable.

*Amount of cane used for seed not reported.

Appendix Table XII. Relation between direct labor costs per ton of cane sold and cost of producing cane on large sugar cane farms in Louisiana in 1945.

Direct labor costs per ton cane sold	No. of farms	Total costs	General over-head	Planting and cultivat.	Harvest-ing	Other crops	Interest
Less than 2.00	23	$5.98	$3.13	$1.20	$ .95	$ .25	$ .45
2.00 to 2.49	15	6.60	3.19	1.59	1.11	.24	.47
2.50 and over	16	6.81	2.95	1.78	1.28	.27	.53
All farms	54	6.31	3.11	1.42	1.06	.25	.47

Appendix Table XIII. Relation between direct labor costs per ton of cane sold and income on large sugar cane farms in Louisiana in 1945.

Direct labor costs per ton cane sold	No. of farms	Total receipts	Cane sold	Govern-ment payments	Other income	Net operating income	Net income
Less than 2.00	23	$7.25	$4.31	$2.43	$ .51	$1.73	$1.27
2.00 to 2.49	15	7.82	4.96	2.36	.50	1.69	1.22
2.50 and over	16	7.67	4.82	2.42	.43	1.38	.85
All farms	54	7.49	4.59	2.41	.49	1.65	1.18

Appendix Table XIV. Relation between direct labor costs per ton of cane sold and various physical factors affecting production costs on large sugar cane farms in Louisiana in 1945.

Direct labor cost per ton of cane sold	No. of farms	Acres in cultiva. per farm	Acres in cane per farm	Tons cane produced per farm	Tons cane sold per farm	Yield of cane per acre-tons	% culti-vat'd area in cane
Less than 2.00	23	1,698	1,136	26,158	25,106	23.0	66.9
2.00 to 2.49	15	1,593	1,053	22,792	21,490	21.6	66.1
2.50 and over	16	1,071	657	12,663	12,049	19.3	61.4
All farms	54	1,483	971	21,224	20,232	21.8	65.5

Appendix Table XV. Geographic variations in the costs and returns from the operation of large sugar cane farms in Louisiana, average per ton of cane sold, for the years 1937 through 1945, inclusive.

Items of cost and return	1937			1938			1939			1940			1941		
	Lafourche 12 farms	Teche 8 farms	Miss. 13 farms	Lafourche 13 farms	Teche 9 farms	Miss. 13 farms	Lafourche 30 farms	Teche 30 farms	Miss. 28 farms	Lafourche 28 farms	Teche 28 farms	Miss. 33 farms	Lafourche 23 farms	Teche 36 farms	Miss. 17 farms
	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
General overhead	2.20	1.94	1.63	1.82	1.58	1.51	1.68	1.47	1.64	2.60	2.43	2.51	1.89	1.84	1.95
Planting and cultivating	1.05	1.23	1.02	.91	1.11	.90	1.00	1.01	.95	1.54	1.58	1.43	.96	1.23	1.04
Harvesting cane	1.02	.93	1.22	.97	.97	1.15	.87	.84	.98	.77	.77	.87	.67	.72	.86
Other crops	......	......	......	.17	.16	.20	.26	.26	.13	.32	.28	.33	.19	.19	.15
Interest	.44	.41	.49	.44	.35	.43	.49	.47	.43	.60	.64	.66	.53	.61	.50
TOTAL	4.71	4.51	4.36	4.31	4.17	4.19	4.30	4.05	4.13	5.83	5.70	5.80	4.24	4.59	4.50
Misc. credits	.44	.51	.34	.34	.59	.42	.55	.46	.48	.49	.48	.57	.54	.36	.52
Net cost	4.27	4.00	4.02	3.97	3.58	3.77	3.75	3.59	3.65	5.34	5.22	5.23	3.70	4.23	3.98
Income from cane sales	2.32	3.00	2.94	2.67	2.72	2.60	3.05	2.97	2.85	2.65	2.69	2.67	1.99	3.29	3.85
AAA payments	.88	1.04	.96	.85	.93	.90	.99	.91	.95	1.05	1.16	1.04	.68	.70	.83
Miscellaneous sources	.44	.51	.34	.34	.59	.41	.55	.46	.48	.49	.48	.57	.54	.36	.52
TOTAL INCOME	4.14	4.55	4.24	3.86	4.24	3.91	4.59	4.34	4.28	4.19	4.33	4.28	3.21	4.35	5.20
Operating expenses	4.27	4.10	3.87	3.87	3.82	3.76	3.81	3.58	3.70	5.23	5.06	5.14	3.71	3.98	4.00
Net operating income	—.13	.45	.37	—.01	.42	.15	.78	.76	.58	—1.04	—.73	—.86	—.50	.37	1.20
Net income	—.57	.04	—.12	—.45	.07	—.28	.29	.29	.15	—1.64	—1.37	—1.52	—1.03	—.24	.70
Capital investment	8.85	8.31	9.90	8.76	6.91	8.55	9.79	9.38	8.53	11.94	12.82	13.10	10.65	12.27	10.03

(Continued)

Appendix Table XV. (Continued) **Geographic variations in the costs and returns from the operation of large sugar cane farms in Louisiana, average per ton of cane sold, for the years 1937 through 1945, inclusive.**

Items of cost and return	1942			1943			1944			1945		
	Lafourche 12 farms	Teche 26 farms	Miss. 14 farms	Lafourche 13 farms	Teche 26 farms	Miss. 16 farms	Lafourche 13 farms	Teche 25 farms	Miss. 16 farms	Lafourche 13 farms	Teche 25 farms	Miss. 16 farms
	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
General overhead	2.66	2.11	2.29	2.37	2.46	2.45	2.82	2.66	3.29	3.26	2.83	3.26
Planting and cultivating	1.35	1.43	1.12	1.16	1.33	.96	1.26	1.33	1.37	1.45	1.42	1.34
Harvesting cane	.75	.76	.89	1.02	1.03	1.19	1.06	.96	1.19	1.09	.91	1.19
Other crops	.21	.32	.12	.21	.18	.09	.28	.27	.09	.24	.24	.29
Interest	.50	.50	.35	.52	.48	.33	.52	.45	.37	.50	.43	.48
TOTAL	5.47	5.12	4.77	5.28	5.48	5.02	5.94	5.67	6.31	6.54	5.83	6.56
Misc. credits	.53	.49	.58	.46	.39	.39	.56	.40	.64	.53	.48	.43
Net cost	4.94	4.63	4.19	4.82	5.09	4.63	5.38	5.27	5.67	6.01	5.35	6.13
Income from cane sales	4.31	4.36	4.34	4.39	4.58	4.36	4.79	4.62	4.31	4.93	4.59	3.96
AAA payments	.90	.97	.84	1.25	1.06	1.21	1.44	1.39	1.49	2.39	2.21	2.71
Miscellaneous sources	.53	.49	.58	.46	.39	.39	.56	.40	.64	.53	.48	.43
TOTAL INCOME	5.74	5.82	5.76	6.10	6.03	5.96	6.79	6.41	6.44	7.85	7.28	7.10
Operating expenses	4.97	4.62	4.42	4.76	5.00	4.69	5.42	5.22	5.94	6.04	5.40	6.08
Net operating income	.77	1.20	1.34	1.34	1.03	1.27	1.37	1.19	.50	1.81	1.88	1.02
Net income	.27	.70	.99	.82	.55	.94	.85	.74	.13	1.31	1.45	.54
Capital investment	10.09	10.05	6.98	10.47	9.61	6.63	10.40	9.08	7.32	10.02	9.73	8.58

Appendix Table XVI. Geographic variations in the size of business and operating results of large sugar cane farms in three regions in Louisiana, 1937 through 1945, inclusive.

Operating Items	1937			1938			1939			1940			1941		
	Lafourche 12 farms	Teche 8 farms	Miss. 13 farms	Lafourche 13 farms	Teche 9 farms	Miss. 13 farms	Lafourche 30 farms	Teche 30 farms	Miss. 28 farms	Lafourche 28 farms	Teche 28 farms	Miss. 33 farms	Lafourche 23 farms	Teche 36 farms	Miss. 17 farms
Cane produced—tons	39,841	36,316	19,082	39,902	32,506	19,330	16,647	14,188	13,541	11,502	8,267	8,173	16,454	10,159	12,456
Cane sold—tons	37,450	33,567	17,899	37,638	30,192	18,097	15,152	13,044	12,493	10,293	7,469	7,287	15,036	9,228	11,478
Cane grown—acres	1,936	1,765	844	1,686	1,451	823	707	617	575	754	549	538	860	515	576
Yield of cane per acre—tons	20.57	20.58	22.61	23.67	22.40	23.49	23.55	23.00	23.55	15.25	15.06	15.19	19.13	19.73	21.63
Size of farms—acres	7,460	6,341	2,757	6,991	4,765	2,666	1,918	1,919	1,650	1,919	1,491	1,757	2,128	1,665	1,914
Cultivated area—acres	2,791	2,988	1,459	2,653	2,395	1,338	1,232	1,101	1,048	1,250	957	908	1,357	888	874
Per cent total area cultivated	37.40	47.12	52.92	37.95	50.26	50.19	64.23	57.37	63.52	65.14	64.19	51.68	63.77	53.33	45.66
Per cent total area in cane	26.00	27.83	30.61	24.12	30.45	32.52	36.86	32.15	34.85	39.29	36.82	30.62	40.41	30.93	30.09
Per cent cultivated area in cane	69.37	59.07	57.85	63.55	60.58	61.51	57.39	56.04	54.87	60.32	57.37	59.25	63.38	57.99	65.90

(Continued)

Appendix Table XVI. (Continued) Geographic variations in the size of business and operating results of large sugar cane farms in three regions in Louisiana, 1937 through 1945, inclusive.

Operating Items	1942			1943			1944			1945		
	Lafourche 12 farms	Teche 26 farms	Miss. 14 farms	Lafourche 13 farms	Teche 26 farms	Miss. 16 farms	Lafourche 13 farms	Teche 25 farms	Miss. 16 farms	Lafourche 13 farms	Teche 25 farms	Miss. 16 farms
Cane produced—tons	37,224	12,577	18,832	35,143	13,513	17,732	35,152	13,591	14,829	38,859	14,941	16,714
Cane sold—tons	34,640	11,883	17,395	33,739	12,501	16,852	33,039	13,126	13,602	36,822	14,420	15,835
Cane grown—acres	2,016	674	865	1,764	669	816	1,679	678	760	1,723	698	788
Yield of cane per acre—tons	18.46	18.66	21.77	19.92	20.20	21.73	20.94	20.05	19.51	22.50	21.40	21.20
Size of farms—acres	4,421	2,066	2,534	*	*	*	*	*	*	*	*	*
Cultivated area—acres	2,884	1,100	1,289	2,649	963	1,351	2,627	1,038	1,159	2,632	998	1,210
Per cent total area cultivated	65.23	53.24	50.87	....	....	....	....	....	....	....	....	....
Per cent total area in cane	45.60	32.62	34.14	....	....	....	....	....	....	....	....	....
Per cent cultivated area in cane	69.90	61.27	67.11	66.59	69.47	60.40	63.91	65.32	65.57	65.50	69.90	65.10

*Figures unavailable for 1943, 1944, and 1945.

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93b

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COSTS AND RETURNS ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

By

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TABLE OF CONTENTS

PAGE

INTRODUCTION 5

METHOD OF PROCEDURE 6

COSTS AND RETURNS FOR EACH YEAR 7

  Volume of Business 7
  Net Returns Per Farm 7
  Costs and Returns Per Acre of Sugar Cane 10
  Costs and Returns Per Ton 10
  Returns Per Hour of Labor 10
  Average Costs and Returns for the 8-year Period, 1938-45 11

ORGANIZATION AND OPERATION OF FAMILY-TYPE SUGAR CANE FARMS 13
  Tenure and Color 13
  Capital Investment 13
  Number and Type of Livestock and Equipment Items 14
  Workstock Use and Costs 14
  Tractor, Truck, and Auto Use and Costs 15
  Man Labor and Workstock Requirements 16

FACTORS AFFECTING NET RETURNS ON FAMILY-TYPE FARMS IN THE LOUISIANA SUGAR CANE AREA 17
  Size of Farm 19
  Yield Per Acre 19
  The Balance of the Farm Business 20
  Efficiency in the Use of Labor 21
  Relation of Superiority in Four Important Factors to Net Returns 22

SUMMARY 23

APPENDIX 26

LIST OF TABLES

TABLE PAGE

1. Number and size of family-type sugar cane farms surveyed in the Louisiana sugar cane area, 1938 to 1945 7
2. Costs and returns from producing sugar cane on family-type sugar cane farms in Louisiana, 1938 to 1945 8
3. Average costs and returns on family-type sugar cane farms in Louisiana for eight years, 1938-1945 11
4. Relation of the combined effect of superiority in size, yield, intensity of cane enterprise, and labor efficiency to returns from farming, Louisiana family-type sugar cane farms, 1944 22

APPENDIX TABLES

I. Average costs and returns per farm on family-type sugar cane farms in Louisiana, 1938-1945 26

II. Costs and returns per acre of cane grown on family-type sugar cane farms in Louisiana, 1938 to 1945 26

III. Costs and returns per ton of cane sold for family-type sugar cane farms in Louisiana, 1938 to 1945 27

IV. Average labor returns to the operator from the sugar cane enterprise for family-type sugar cane farms in Louisiana, 1938 to 1945 27

V. Tenure of farm operators surveyed, family-type Louisiana sugar cane farms, 1938-45 28

VI. Livestock and equipment on family-type Louisiana sugar cane farms, 1942 28

VII. Distribution of capital investment on family-type sugar cane farms in Louisiana, 1942 and 1945 29

VIII. Cost of mule work on Louisiana family-type sugar cane farms, 1938-1945 29

IX. Cost of tractor work on family-type sugar cane farms in Louisiana, 1938 to 1945 30

X. Costs of operating farm trucks on family-type sugar cane farms in Louisiana, 1938 to 1945 30

XI. Costs of operating farm automobiles on family-type sugar cane farms in Louisiana, 1938 to 1945 31

XII. Total labor requirements for planting, growing and harvesting sugar cane on family-type sugar cane farms in Louisiana 31

XIII. Average labor requirements for planting sugar cane on family-type farms in Louisiana 31

XIV. Average labor requirements for cultivating and harvesting sugar cane on family-type sugar cane farms in Louisiana 32

XV. Relation of acres of cane per man to costs and returns for family-type sugar cane farms in Louisiana 32

XVI. Relation of size of farm to costs and returns for family-type sugar cane farms in Louisiana 33

XVII. Relation of yield per acre of sugar cane to costs and returns per family-type sugar cane farm in Louisiana 34

XVIII. Relation of proportion of crop land in sugar cane to costs and returns for family-type sugar cane farms in Louisiana 35

COSTS AND RETURNS ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

J. NORMAN EFFERSON

INTRODUCTION

Detailed farm management and cost studies of the operation of family-type sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station for most of the years since 1938.[1] For each year studied, the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. Records, collected by the survey method, were obtained from 500 family-type farm operators in 1938, 453 in 1940, 467 in 1942, 110 in 1943, 110 in 1944, and 508 in 1945.[2] There were about 8,000 family-type sugar cane farmers in Louisiana during this period; thus the sample studied in most of the years represents between 5 and 10 per cent of the total number of farmers in the area.

The purpose of this report is to summarize briefly the average costs and returns on family-type sugar cane farms in Louisiana for each of the years studied from 1938 to 1945, to point out the major reasons why relative returns varied from year to year, to present an outline of the labor and machinery requirements and costs in the production of sugar cane in Louisiana, and to summarize an analysis of the major factors affecting the success or failure of sugar cane growers on family-type farms in the region. A family-type farm is a very elastic item because of differences in intensity but can be defined best as a farm which is small enough so that at least one-half of all the man labor operations required in the growing or production of the crop and livestock enterprises on the farm are done by the farm operator or members of his family and which is large enough so that at least one-half of the gross income of the farm family is derived from the farm.

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[1] *A Farm Management and Cost Study of 500 Family-Sized Farms in the Louisiana Sugar Cane Area, 1938* (Louisiana Experiment Station Bulletin No. 314, February, 1940); *Costs and Returns from 453 Family-Sized Sugar Cane Farms in 1940* (Department of Agricultural Economics Mimeographed Circular No. 25, March, 1942); *Economic Aspects of Sugar Cane Production in Louisiana, 1941* (Department of Agricultural Economics Mimeographed Circular No. 26, June, 1942).

[2] The field schedules for the 1938 studies were collected by W. W. McPherson, Ward Jenson, and J. N. Efferson; for 1940, by Frank Merrick, Herbert Blanchard, Henry Hardee, and W. R. McNeese; for 1942, by Morris McGough, James Hudson, Peter Simonelli, and J. N. Efferson; for 1943, by Roy Bass and J. N. Efferson; for 1944, by Albert Haynes and J. N. Efferson; and for 1945, by Carl Jones, L. P. Whittington, I. C. Anderson, Roy Johnson, Edwin Goodwin, and J. N. Efferson.

METHOD OF PROCEDURE

The farms selected as the sample for the first year's study, the 1938 crop year, were chosen on the basis of a stratified-random sampling technique in which a 5 per cent sample, weighted in accordance with the importance of the sugar cane enterprise in each parish, was selected from the lists of sugar cane growers and acreages per farm supplied by the Agricultural Adjustment Administration. In succeeding years, all of the producers contacted the previous year were visited and where by reason of transfer of farm ownership, retirement, or for other reasons the original cooperators were not available, the next farm adjoining the one missed was contacted. In this way, the continuity of the original sample was maintained and the total volume maintained by the selection of new cooperators to replace those not available. More than one-half of the farms surveyed in 1945, the most recent year of this series of studies, were the same farms surveyed in 1938.

Each producer selected was visited by a trained enumerator each year. This enumerator collected from the farmer the detailed results of his previous year's farming operations, including expenses, receipts, practices, and capital changes.

There are two common methods of computing costs and net returns on farms having a specialized enterprise as the main source of income. The first method is to charge all farm expenses, both direct and indirect, to the major enterprise and to credit it with the small miscellaneous sources of income, to result in a "net cost" for the important enterprise. This method is much simpler, easier, and more rapid to use in computing sugar cane costs and returns, but it has the disadvantage of assuming that the returns from all of the small minor enterprises are enough to balance off exactly the costs of these enterprises, which may or may not be true. If the minor enterprises have not paid expenses, this will result in a higher cost of production for the major enterprise; if the minor enterprises have shown a profit, the net result will be a lower cost for the major enterprise.

The second method is to charge as expenses of the most important enterprise all the direct expenses and then allocate the various indirect expenses according to the proportion of use on the major enterprise. This method is much more difficult to compute and is subject to question because of the detailed accounting and allocating procedure involved but is probably more accurate on farms where there are several important enterprises.

Both methods have been used in this analysis of sugar cane costs and returns on family-type farms in Louisiana; after several years trial, however, it was found that the income from sugar cane on the farms studied in this area amounted to from 80 to 90 per cent of the total income; thus, the "net cost" method was adopted for the long-time series because of its simplicity and relative accuracy under such conditions.

COSTS AND RETURNS FOR EACH YEAR

A brief summary of the average financial results from the operation of family-type sugar cane farms in Louisiana for each of the years studied from 1938 to 1945 is shown in Tables 1 and 2. A more detailed analysis of the costs and returns for each year on a per farm, per acre of cane grown, and per ton of sugar cane sold basis is presented in Appendix Tables I to IV.

Volume of Business

The average volume of business for the family-type farms studied from 1938 to 1945, including the number of farms surveyed each year, the acreage of sugar cane and other crops per farm, the yield of cane per acre, and the tonnage of cane sold per farm, is indicated in Table 1.

TABLE 1. Number and Size of Family-Type Sugar Cane Farms Surveyed in the Louisiana Sugar Cane Area, 1938 to 1945

Item	1938	1940	1942	1943	1944	1945
Number of farms	500	453	467	110	110	508
Acres of cane per farm	41	35	35	44	42	32
Total acres in crops per farm	86	85	73	91	85	70
Yield of cane per acre	22	14	17	23	22	23
Tons of cane sold per farm	835	460	605	937	841	691

From 1938 to 1945, the volume of business of the producers of sugar cane in the region varied widely but with an indicated trend towards slightly smaller acreages of sugar cane, reduced acreages in total crops of all types, and a slightly higher percentage of the total cropland being planted to sugar cane. The 500 farms studied in 1938 had a total of 86 acres of all crops per farm, with 41 acres in sugar cane, while the 508 producers surveyed in 1945 had only 70 acres in all crops and 32 acres in sugar cane. This trend of a smaller volume of business was due apparently to the shortage of available hired labor during the war years which caused producers to reduce acreages to fit the visible supply of family labor and the reduced supply of hired labor in sight.

Average yields per acre on the farms studied varied from a high point of about 23 tons per acre in 1943 and 1945 to only 14 tons per acre in 1940. For the six years studied, the average yield was less than 20 tons in 2 years, from 20 to 22 tons per acre in 2 years, and averaged 23 tons in 2 years. Yields for the farms studied were slightly higher in some years than average yields for the state as a whole but followed the same general trends.

Net Returns Per Farm

The average costs and returns per farm for each of the six years studied from 1938 to 1945 are shown in Table 2. For purposes of simplicity, all farm expenses have been grouped under two headings, *direct farm expenses* and *rent and interest.* The first of these groups includes

TABLE 2. COSTS AND RETURNS FROM PRODUCING SUGAR CANE ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

COSTS AND RETURNS PER FARM	1938	1940	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Direct farm expenses	2,876	2,173	2,576	3,950	4,212	3,786
Rent and interest	693	613	718	1,068	1,254	1,153
Total farm expenses	3,569	2,786	3,294	5,018	5,466	4,939
Receipts from sources other than sugar cane	413	494	642	525	913	981
Net cost of producing sugar cane	3,156	2,292	2,652	4,493	4,553	3,958
Total returns from cane sold	3,075	1,689	3,169	5,407	5,524	4,840
Profit from sugar cane to pay operator for his labor	– 81	– 603	517	914	971	882
Value of farm privileges	321	343	510	530	763	696
Total cash and non-cash profits from sugar cane	240	– 260	1,027	1,444	1,734	1,578
Cash return per month	– 7	– 50	43	76	81	74
Non-cash return per month	27	29	43	44	64	58
Total return per month to pay operator for his labor	20	– 21	86	120	145	132

all the usual farm expenses such as feed, seed, hired labor, repairs, fertilizer, and other similar items. The second, *rent and interest,* includes the actual rent paid by the operators of tenant farms and a computed interest charge of 5 per cent on the average capital investment for owner-operated farms. Interest actually paid by the farmers for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This approach placed all farms on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. A detailed breakdown of all of the individual items of cost and return is shown in Appendix Table I.

Total farm expenses varied from $2,786 per farm in 1940 to $5,466 in 1944, or was about twice as high in 1944 as in 1940. This was due to two major factors: the prices paid for the major items used on these sugar cane farms increased rapidly during the war years; in addition, the relatively low volume of business in 1940, due to a partial loss of the crop because of adverse weather, caused harvesting expenses to be low since there was little cane to harvest, while the volume of business in 1944 was relatively large. Costs per farm in 1945 were slightly lower than in 1944 in spite of the continued increase in unit costs for items purchased because of the smaller volume of business on the farms studied in 1945 in comparison with those surveyed in 1944.

The net costs of producing sugar cane, or the difference between total costs and income from sources other than sugar cane, varied in about the same proportion as total costs, being about twice as great in 1944 as in 1940.

The net cash profit from sugar cane production to pay the operator for his labor varied from a high point of around $900 per farm in 1943 and 1944 to a loss of more than $600 per farm in 1940. On the average, these family-type sugar cane producers lost money in two of the six years studied and made peak earnings of from $800 to $900 per farm in three of the six years. On a monthly basis, these farmers made peak cash earnings of about $75 per month or $3 per working day in 1943, 1944, and 1945; made $43 per month in 1942, but lost $7 per month in 1938 and $50 per month in 1940.

These costs and returns data give a clear indication as to the reason why more than 2,000 family-type sugar cane producers, or 20 per cent of the farmers producing sugar cane in Louisiana, stopped producing sugar cane between 1940 and 1945.[3] Although they did make cash earnings of $3 per day in the period from 1943 to 1945, the memory of 1940, when in addition to making no profit they lost about $2 a day, plus the knowledge that they could earn twice as much or even more than the current level of $3 by working for nearby industries caused many to abandon sugar cane farming during the war years.

There are additional advantages, however, which family-type farmers have that are not enjoyed by industrial workers and are not reflected in cash net earnings. These are the so-called farm privileges or non-cash items of value which a farmer receives by virtue of the fact that he lives on a farm. It it were not for these non-cash values, an even larger proportion of the family-type sugar cane producers in Louisiana would have left the farms during the war years.

For each year studied, all producers contacted were asked to place their own values for these non-cash items. The total of these farm privileges averaged about $300 per farm in the 1938-40 period but increased to about $700 per farm in 1944 and 1945. This amounted to a non-cash return in addition to the cash earnings of about $30 per month in the pre-war years and up to $60 per month during the last years of the war. By adding these non-cash returns to the cash returns, a total earnings figure that is comparable to the earnings of industrial workers can be obtained. For the sugar cane farmers surveyed, total labor earnings for the year's work averaged $20 per month in 1938, a loss of $21 per month in 1940, and profits of $86 per month in 1942, $120 per month in 1943, $154 in 1944, and $132 in 1945.

These family-type sugar cane farmers had average capital investments totaling about $8,000 per farm in the pre-war years but increasing to about $12,000 per farm in 1944 and 1945. They valued their own labor at the rate they could have earned if they had worked for nearby farmers and varied it from $400 per year in 1938 to $1,100 in 1944. If they had charged the value of their own labor to the farm at these rates during the years studied, they would have made a return on their capital investment varying from a loss of about 10 per cent in 1940 to a gain of about 6 per cent in the peak year, 1943, with losses occurring in two years, a return to capital varying from 1 to 4 per cent in 3 years, and a return of more than 5 per cent in 1 year.

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[3] *U. S. Census of Agriculture, 1945.*

Costs and Returns Per Acre of Sugar Cane

A summary of the average costs and returns per acre of sugar cane for the farms studied from 1938 to 1945 is shown in Appendix Table II. The net cost of producing sugar cane varied from about $70 per acre in the 1938-40 period to $76 in 1942, $102 in 1943, $108 in 1944, and $124 in 1945. This represents an increase of about 80 per cent in unit costs from 1940 to 1945.

The net cash income over all expenses except the value of the farmer's own labor amounted to a loss of $2 per acre in 1938, a loss of $17 per acre in 1940, and a profit of from $15 to $27 per acre from 1942 to 1945. Including the value of the operator's labor at rates he could have earned on other farms, the final gain or loss amounted to a $23 per acre loss in 1940 and gains of from $11 to $21 in 1942 to 1945.

Costs and Returns Per Ton

A summary of the average costs and returns per ton of sugar cane sold for the farms surveyed from 1938 to 1945 is presented in Appendix Table III. The net cost of producing a ton of sugar cane varied from $3.78 in 1938 to $5.73 in 1945. Adding to these figures the value of the farmer's own labor to obtain a net cost equivalent to the net cost of a business concern, the result is an average cost of $4.29 per ton in 1938 to $7.02 per ton in 1945.

From the point of view of the producer, the cash profit remaining to pay him for his labor on the crop amounted to a loss of $1.24 per ton in 1940 and a gain of around $1 per ton for the 1942-45 period. It is interesting to note that during this period, these farmers valued their own labor at about the same rate as the actual cash earnings from the sugar cane enterprise. In other words, they made about the same cash return working on their own farms as they would have made working for nearby farmers, but had the added advantage of the relative security of working on their own farms plus the assurance of obtaining the non-cash perquisites.

Returns Per Hour of Labor

The average labor returns to the operators of family-type sugar cane farms in Louisiana for the 1938-45 period are shown in Appendix Table IV. The farmers surveyed lost from 3 to 24 cents per hour worked in 1938 and 1940 and made cash returns of from 20 to 38 cents per hour from 1942 to 1945. In addition, their non-cash farm privileges amounted to from 12 to 30 cents per hour worked on the farm. Thus, their total returns, including both cash and non-cash items, varied from about 10 cents per hour in 1938 and 1940 to from 40 to 68 cents per hour during the 1942-45 period.

The farmer's estimate of the value per hour of his own labor was about equal to the cash return per hour for the 1938-45 period as a whole, although variations occurred from year to year. The minimum wage rate set by the Department of Agriculture under the provisions of the 1937 Sugar Act also averaged about the same as the average cash earnings of the family-type farmers surveyed; in 2 years of the 6, the hourly earnings of these family-type farmers were much lower than the established minimum wage rates; in 1 year, the earnings were at the same level; and in 3 years, the hourly earnings of the farm operators were about 12 cents per hour higher than the minimum wage rates for hired labor.

Average Costs and Returns for the 8-Year Period, 1938-45

A summary of the average costs, returns, and net profits for all of the farms studied for the entire eight-year period, 1938 to 1945, is shown

TABLE 3. AVERAGE COSTS AND RETURNS ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA FOR EIGHT YEARS, 1938-45

COSTS AND RETURNS	AVERAGE FOR THE 8-YEAR PERIOD			
	Per farm	Per acre of all crops	Per acre of cane	Per ton of cane sold
	Dollars	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:				
Cane sold for sugar*	3,951	48.18	103.97	5.43
Other crops sold	415	5.06	10.92	.57
Livestock and livestock products	77	.94	2.03	.11
Other income	169	2.06	4.45	.23
Total receipts	4,612	56.24	121.37	6.34
Farm Expenses:				
Hired labor	1,681	20.50	44.24	2.31
Unpaid labor†	271	3.30	7.13	.37
Fertilizer	192	2.34	5.05	.26
Feeds, seeds, and plants	112	1.37	2.95	.15
Machinery and building costs	413	5.04	10.87	.57
Land rent[1]	429	5.23	11.29	.59
Interest	487	5.94	12.81	.67
All other expenses	593	7.23	15.60	.82
Total expenses	4,178	50.95	109.94	5.74
Income:				
Labor income	434	5.29	11.42	.60
Value of farm privileges	527	6.43	13.87	.72
Labor earnings	961	11.72	25.29	1.32
Value of operator's time	717	8.74	18.87	.98
Return to capital	204	2.49	5.37	.28
Per cent return to capital	2	......	......	......
Capital investment, dollars	9,740	119	256	13
Acres in all crops	82	1	......	......
Acres in cane	38	......	......	......
Tons of cane sold	728	9	19	......

*Total receipts from cane sold, including government payments.

†Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

[1] Includes land rent at actual cost and interest on owned investment at 5 per cent of the value of the depreciated assets.

in Table 3. These data are computed on the basis of a simple average of the results for each year studied. A simple average was used because the number of farms studied varied from more than 500 in some years to 110 in others; thus a weighted average would overemphasize the results of the years in which a relatively large number of records were obtained.

For the entire period, the farms studied had an average annual volume of business of 82 acres in all crops, 38 acres in sugar cane, 728 tons of cane sold per year, and a capital investment of $9,740 per farm. They obtained an 8-year average sugar cane yield of 19 tons per acre and had an average capital investment of $13 per ton of cane sold.

During the 1938-1945 period, these family-type sugar cane farmers produced sugar cane at an average cost of $110 per acre, or $5.74 per ton of cane sold, not including the value of the unpaid labor of the farm operator as a cost. Of the total expenses, 47 per cent was made up of direct labor costs, 22 per cent for rent and interest, and 31 per cent for all other costs.

The average annual gross income for the period amounted to $121 per acre, or $6.34 per ton of cane sold. Of this amount, $5.43 per ton, or 86 per cent, was income from sugar cane and the remaining 14 per cent was income from other farm products.

The labor income, or the amount of cash remaining to pay the farm operator for his year's work on the farm, averaged $434 per farm, $11 per acre of cane produced, or $0.60 per ton of cane sold. In addition, these farmers received an average of $527 per year, or $0.72 per ton of cane sold, in the form of the non-cash value of the farm perquisites or privileges produced by the farm and used by the farm family, making total annual labor earnings for the period $961 per farm, or $1.32 per ton of cane sold.

If the records are adjusted according to the usual accounting methods used by business firms in which all labor is included as a cost and the value of a farmer's own labor added in order to obtain a net income representing the return to the capital investment, the result is an average return to capital of $204 per year on the capital investment of about $10,000, or an average annual return of 2 per cent.

These facts indicate that in Louisiana the family-type sugar cane farmers who remained in production throughout the war years did not operate at a loss but did operate at a monthly earnings level of $80 per month, including both cash and non-cash items of income, which probably is considerably less than that earned by their neighbors who left their farms and went to work for wartime industries. On the other hand, these producers did have, and still have, a fairly stable job. They have maintained their capital investments and they have had, and still have, more freedom of action and greater security than their neighbors who left the farm.

ORGANIZATION AND OPERATION OF FAMILY-TYPE SUGAR CANE FARMS

In order to interpret and use the cost and return data in the most efficient manner, it is necessary that a background be obtained of the essential physical and economic factors relative to the farm organization and operation of the farms studied. This series of annual studies of family-type sugar cane producers in Louisiana from 1938 to 1945 has made possible the collection of much additional information on sugar cane farming in the region other than the usual cost and return data. Some of the more important of this related information follows.

Tenure and Color

In 1938, the first year of the series, 33 per cent of the farmers surveyed owned all the land they operated; 31 per cent operated as part-owners and renters, farming the place on which they lived and renting additional land; 16 per cent rented their farms for a stipulated cash sum agreed on between the landlord and tenant at the beginning of the growing season; and the remaining 20 per cent rented their farms on a share basis. The most usual share arrangement was for the farm operator to pay one-fourth of the cane, corn, and cotton crop for the use of the entire farm, including a house in which to live, for the year.

During the period of time covered by these annual studies, there were no important changes in the relative tenure of the farmers studied. In 1945, the most recent year studied, of the 507 farmers surveyed, 44 per cent were full owners, 13 per cent were part owners and renters, 21 per cent were cash renters, and 22 per cent were share renters (Appendix Table V). The most significant change noted during this 8-year period was the gradual shift toward more full owners and fewer part owners and renters.

There were no significant changes in the relative number studied in each color group. In 1938 and in 1945, approximately 85 per cent of the family-type farmers interviewed were white operators and 15 per cent were Negro farmers.

Capital Investment

Total capital investment of owner-operated family-type sugar cane farms in the Louisiana area averaged $12,000 per farm in 1942 but increased to more than $17,000 per farm in 1945 (Appendix Table VII). This 40 per cent increase in the capital investment needed to operate approximately the same size farm with the same amounts and types of enterprises was due to increased land values and increased building costs during the war years. The average investment in livestock, other equipment, and tractors also increased slightly during this period because of increased costs for these items. In 1945, of the total investment on owner operated farms, 53 per cent was in land, 25 per cent for buildings, 8 per cent for livestock, and 14 per cent for machinery and equipment.

Even the tenant farmers needed some capital to operate a sugar cane farm. In 1942, the average investment per tenant farm amounted to about $1,200 per farm, with 63 per cent of this total invested in livestock, mostly workstock, and 37 per cent in machinery and equipment. By 1945, the total investment per tenant farm had increased to almost $2,500 per farm, with most of the increase being in investments in machinery and equipment.

Number and Type of Livestock and Equipment Items

A detailed summary of the average number of livestock and number of important items of machinery and equipment per farm in 1942, which is the year most representative of average conditions for the entire period, 1938-45, is shown in Appendix Table VI. These facts indicate that the family-type sugar cane farms in the area were typically 4-mule farms, with one-fourth of the farmers owning a tractor, one-third of them owning a farm truck, and two-thirds of these farmers operating an automobile for farm and personal use.

Three-fourths of the farmers studied kept dairy cows on their farms for the production of milk for farm use, with an average of 4 dairy cows per farm on these farms. About 90 per cent of the farm operators had hogs and chickens for home consumption purposes, with an average of 7 hogs per farm and 82 chickens.

The only items of equipment that were inventoried on every farm surveyed were single plows, with an average of 3 per farm; spike-tooth harrows, averaging 2 per farm; wagons to the extent of 2 per farm; and in addition, 6 hand hoes, 11 cane knives, and 4 sets of work gears per farm. With these items of equipment—a plow, a harrow, hoes, a wagon, cane knives to cut the cane and wagons to haul the crop to the derrick, and a team of workstock plus work gears—it is possible to plant, grow, and harvest sugar cane, and some of the farmers studied produced the crop with just these items.

Many of the producers, however, had additional items of equipment. Most of them had walking cultivators and more than one-half of those surveyed had middle busters, mowing machines, planters, riding cultivators, and cane shavers. The average depreciated value per unit of equipment for these items and all other machinery and equipment found on the farms studied is shown in Appendix Table VI also.

Workstock Use and Costs

The average mule on the family-type sugar cane farm worked about 1,000 hours per year, cost $150 at the age of three or four years, broken for field work, and had an average useful life on the farm of 8 years after the purchase date. In the 1938-41 pre-war period, mule work cost family-type sugar cane farmers an average of 14 cents per hour, but increased to 16 cents in 1942, 20 cents in 1943, 24 cents in 1944, and 26 cents per hour in 1945 (Appendix Table VIII). The most important factors causing this increase of almost 100 per cent in workstock costs from 1938 to 1945 were the increased prices of grain and hay for feed, which more than doubled from 1941 to 1945, and the increased costs for man labor required for the care and maintenance of the workstock. In 1945, the most recent year for which such costs are available, grain costs comprised 50 per cent of total workstock expenses; hay costs were 21 per cent; labor costs, 12 per cent; and all other expenses, including depreciation, interest, shoeing, veterinary fees, use of buildings, and harness expenses, were 17 per cent of the total.

Tractor, Truck, and Auto Use and Costs

Of the 500 family-type sugar cane producers studied in 1938, 85 had tractors for use on the farm; of the 507 farms surveyed in 1945, 176 had tractors. In 1938, 17 per cent of the farms reported tractors and the relative number increased to 35 per cent in 1945. In 1938, the tractors on these farms were used an average of 82 nine-hour days per year, as compared with 103 days in 1940, 149 days in 1942, and 179 days in 1945. These facts indicate that not only has the number of tractors on family-type sugar cane farms doubled from 1938 to 1945, but also the relative use per tractor has increased by about 100 per cent during the same period.

Because of the increased use made of the available tractor power on these farms, the total cost per hour of tractor use did not increase during the 1938-45 period, even though costs per unit for most items of tractor expense did increase. In 1938, the average cost per hour of use was 61 cents as compared with 55 cents in 1940, 45 cents in 1942, and 55 cents in 1945 (Appendix Table IX). Operating costs, including all fuel and repairs, accounted for from 55 to 60 per cent of total tractor costs, and overhead expenses, including depreciation and interest, varied from 40 to 45 per cent of the total. Operating costs per day of use remained about the same throughout the 1938-45 period, but overhead costs decreased because of the increased use of the machines during the latter years of the period.

In 1938, 15 per cent of these sugar cane producers owned trucks for farm use, and the relative number of trucks increased to 24 per cent by 1945. Most of these trucks were small one-half-ton to one-ton trucks, usually purchased on used-car lots, and used on the farms for general farm work such as hauling feed, supplies, and labor, and in some cases cane from the field to the derrick. The trucks studied were used to the extent of about 6,000 miles per year and were valued at from $361 per truck in 1938 to $679 in 1945 (Appendix Table X).

Truck costs varied from less than 6 cents per mile in 1938 to about 8½ cents per mile in 1945. In this case, operating costs, primarily increased expenses for tires and repairs during the war years, were the major reasons for the advance in total costs per mile. Overhead costs varied for different years of the period but were about the same in 1945 as in 1938.

About one-half of the farmers interviewed owned automobiles, which they operated for both farm and personal uses. The relative number of such cars, however, actually decreased from 1938 to 1945; 56 per cent had automobiles in 1938 as compared with 50 per cent in 1945. These cars, as in the case of the farm trucks, usually were purchased at used-car lots, and during the war years the price of used cars increased to the extent that some of the producers were not able to purchase replacements. The cars studied were driven from 6 to 7 thousand miles per year, were valued at from $380 per car in 1938 to $548 in 1945, and were used for farm purposes to the extent of 55 per cent of the total mileage in 1938 and 62 per cent in 1945 (Appendix Table XI).

Total costs per mile varied from about 3 cents in 1938 to 5½ cents in 1945. Both operating and overhead costs per mile increased during the 1938-45 period, with operating costs increasing about 100 per cent owing to increased repairs and tires for such used cars and overhead costs about 50 per cent because of higher depreciation and interest rates on the increased value per car.

Man Labor and Workstock Requirements

Along with the financial and physical data collected from family-type sugar cane farmers for the 1938-45 period, information relative to the actual hours of man labor and workstock used to produce sugar cane also was obtained. Since less than one-fourth of the farmers interviewed for the entire period used tractors in the production of sugar cane, and even on the farms with tractors much of the power work was still done with mules, the typical family-type sugar cane farm can be considered primarily as a man and mule operation, and the labor requirement data are presented on this basis.

On any farm, the amount of mule work and man labor required to produce a crop varies widely from year to year, depending on the condition of the fields, the quality of the hired labor, weather conditions, degree of grass and weed infestation, the yield per acre, and many other similar factors. Because of these reasons, any labor requirement data cannot be considered completely accurate indicators of the exact labor requirements on a specific individual farm but, if assembled from the experience of a large group of farmers over a period of five or more years, can be considered to be a fairly reliable guide to measure general labor requirements from area to area or for different groups of farms in an area.

On the farms studied, the average man labor requirements for planting, growing, and harvesting one acre of sugar cane amounted to 184 hours for the 1938-45 period; about 100 mule hours were needed per acre (Appendix Table XII). Since the usual cropping system provided for cutting one plant cane crop and one stubble crop of sugar cane from each acre planted, these total requirements include the planting labor for one-half acre. Also, the harvesting labor represents the amount required when an average yield of 20 tons per acre is obtained; this item tends to vary directly with the average yield harvested. Of the total labor requirements, 9 per cent were for planting operations, 39 per cent for all growing work, and 52 per cent were for harvesting the crop.

A detailed breakdown of the individual farm operations involved in planting, growing, and harvesting an acre of sugar cane as done on the family-type farms studied is presented in Appendix Tables XIII and XIV.

FACTORS AFFECTING NET RETURNS ON FAMILY-TYPE FARMS IN THE LOUISIANA SUGAR CANE AREA

The unit costs and returns and the profits or losses per farm from the operation of family-type sugar cane farms in Louisiana are affected by a great number of different factors, some under the control of the management and many beyond the control of the individual operators. In this area, the major factors determining the relative costs and returns per farm from year to year are indicated to be the annual variations in the size of the crop, which are the result of weather conditions during the growing season; the kind of prevailing weather during the harvesting season and the presence or absence of damaging frosts; the sucrose content per ton of cane harvested, which is determined in the short run by the weather; and the price received for sugar cane, which is based on the usual cane-purchase contract according to the price of raw sugar. The favorable or unfavorable effect of the first three of these four important factors is dependent, in any one year, on the weather, which is not predictable. The favorable or unfavorable effect of the last factor, the price of sugar cane, is dependent on raw sugar prices which are established at national and international levels.

In any given year under the same climatic conditions and the same price structure, however, there are still variations from farm to farm in costs, returns, and net profits; thus, there are still other reasons for variations in returns in addition to the major ones listed previously. These factors causing one producer to have lower costs and higher returns than another in the same area and in the same year are both physical and economic in character. The physical factors include selection of varieties; disease and insect control; methods of planting, cultivating, fertilizing, and harvesting; and many others. The economic factors include the wide range of managerial operations and decisions during the operation of a farm.

Numerous studies and observations have shown that the first rule of success in sugar cane production, or in any other type of farming, is to know the common farm practices and methods of the region. This is the reason why one frequently observes successful farmers who have no education, business experience, or other special training other than their years of experience on the farm. Also, many examples can be pointed out of well-trained educated business men or farmers from other areas who started off in sugar cane farming and made a dismal failure because of this lack of experience or knowledge of the common farm practices of the area. Thus, the first step towards success in sugar cane farming on a family-type unit is to know, and be able to do well, all the practical jobs connected with the growing and harvesting of sugar cane. It is the conclusion of most farm management specialists that if a prospective farmer does not have that experience in the area in which he intends to farm, then he will be better off in the long run to go to work for a successful producer in the area who knows his job and to learn from him for a few years while doing the job rather than to start out on his own immediately and take the chance of losing everything.

A second important rule of success in farming is to know the scientific principles of crop and livestock production and especially the detailed peculiarities of the production of a specialized crop such as sugar cane. Many successful sugar cane farmers have gained this "know-how" the hard way, through trial and error, observation of others, a thorough study of all available literature on the subject, and day-by-day study of their special problems. Regardless of the source of the facts on scientific principles of crop and livestock production, sugar cane farming is a business and may become a very expensive hobby if the farmer does not know what he is doing, why he is doing it, and why he is not trying out some other way. If in doubt about some special practice, he should look around and see what the great majority of the neighbors are doing, and do likewise. The conservative procedure to follow is to allow the other fellow who has money enough to gamble to do the experimenting or let the agricultural experiment station do it; then when the practice is proved, adopt it.

A third important rule leading towards success in sugar cane farming on family-type units is to know and use the business principles in accordance with which the common farm practices and scientific principles should be applied. These are the so-called farm management principles and were not important in the days when each farm was a self-sufficient unit producing all that was needed for a livelihood and selling very little, but have become more and more important since farming has become specialized and more of a business rather than a way of life. Since this series of studies has been limited to a statistical analysis of the financial results of the operation of family-type sugar cane farms, a study of the effect of the applications of these different business principles on costs and returns has been made but no attempt was made to study the physical and internal-management problems of the family-type sugar cane farmers involved in the first two rules of success as listed, although it is recognized that differences do exist and that these variations cause much of the final difference in returns.

The economic factors that were found to be important in affecting costs and returns, as determined from the statistical analysis of the family-type sugar cane farms surveyed from 1938 to 1945, are size of farm, yield per acre, the balance of the farm business, and efficiency in the use of labor.

Size of Farm

The average size of the family-type sugar cane farm in Louisiana is about 100 acres, with from 35 to 40 acres in sugar cane, 35 acres in other crops, mostly corn, 10 acres in pasture, and the remainder in woods and drainage ditches. The typical farm of this size usually is operated with two or three teams of mules or one to two teams of mules and a tractor and has about $2,000 invested in horse-drawn and/or tractor equipment.

All of the farms, however, are not of this typical or average size. Many of the family-type sugar cane farms in the area had only 15 to 30 acres of cropland, with from 2 to 10 acres in sugar cane, while others were as large as 300 acres in total land, with from 100 to 150 acres in sugar cane.

Within the limits of the size of the family-type farms studied, the larger the size of the farm business as measured in terms of the acreage in all crops or the acreage of sugar cane, the lower were the costs of producing sugar cane, and the greater were the profits from the entire farm business (Appendix Table XVI). This general relationship has held true in all of the years in which these records have been analyzed from 1938 to date, with the exception of 1940. The year 1940 was one of the most disastrous years in the recent history of the Louisiana sugar cane area owing to weather conditions that caused yields to be only about two-thirds of normal; in such a year, the larger the size of the farm, the greater are the losses.

In 1944, for instance, the group of relatively small producers having an average of 10 acres in sugar cane made average labor earnings of $945 for the year's work; the medium-sized group, with 33 acres in cane, had average labor earnings of $1,231; while the large-sized group, with 108 acres in cane per farm, made labor earnings of $3,653. Thus, the producers on small farms earned about $75 per month, those on medium-sized units made $120 per month, while those on fairly large farms made $300 per month. Similar relations of size to returns occurred in most of the other years studied.

A more detailed study of the data indicates that the relatively large family-type producers obtained lower costs and higher returns per unit and per farm because of the larger volume of business and because of the higher efficiency obtained in the use of labor; they produced and harvested larger acreages and greater tonnages per man, and had lower costs per unit for workstock and machinery because of full utilization of these items.

These facts lead to the conclusion that under Louisiana conditions, a size of farm of about 100 acres in crops of which 50 acres are sugar cane is needed to maintain an efficient family-type sugar cane farm.

Yield Per Acre

Farm management studies throughout the United States have shown that within the actual practices of farmers, the higher the crop yields, the higher are the returns from farming. Farms with high yields pay higher returns in depression periods as well as in normal or favorable years. Also, good yields of crops and high production rates for animals are the most important factors in obtaining low costs of production. Farmers with high production rates have lower costs per unit and make higher returns per hour of labor than farmers with lower production efficiency.

This general relationship holds true for sugar cane production on family-type units and is probably the most important factor determining the success or failure of a sugar cane producer. In 1944, for instance, the group of farms that had below average cane yields, making 16 tons per acre, had labor earnings for the year amounting to $927 as compared with $2,594 for the group that had average yields of 29 tons per acre. In 1940, when most farms incurred losses, the only group to show a net profit for the year were the farms with above average cane yields (Appendix Table XVII). In 1938, the small farms with low yields had a cost per ton of cane sold about twice as high as the relatively large family-type units with high yields, indicating that the combined effect of high yields with a large size of business resulted in lower costs and higher returns than either factor alone. Similar relationships have occurred in all the years in which this series of studies has been conducted.

Since the yield of cane is one of the most important factors determining costs, all things that tend to increase yields at a reasonable cost should be given special consideration. These Louisiana studies indicate that in a normal season, the farmer who does not average a 20-ton yield on his entire acreage is also the one who does not make a profit on the enterprise. The only conclusion that can be reached is that the sugar cane producer who plans to remain a cane grower for any length of time must develop all possible ways of increasing his yields if he expects to remain solvent.

The Balance of the Farm Business

There are very few cases in agriculture where one product pays well enough to justify complete dependence on it and to justify idleness part of the year. In the Southern States, especially, the more profitable family-type farms are those which have a diversified farm business with a combination of both crop and livestock enterprises. Unfortunately, however, there is no single combination of enterprises which will fit all individual farms within an area. Thus, the exact combination or arrangement of enterprises is an individual problem in each area and for each farmer.

The Louisiana sugar cane area appears fairly well adapted from the standpoint of climatic and soil conditions to the production of a large number of different farm products. Because of the lack of market outlets for a large volume of certain truck crops and the lack of low-cost pasture lands essential to the production of certain commodities such as beef, however, there appear to be very few enterprises that can be used to supplement sugar cane production. Nevertheless, the possibilities for diversification in this area do exist and in some cases are indicated to be profitable.

These studies from 1938 to 1945 show that on the fairly large family-type sugar cane farms where yields of sugar cane were average or above, the larger the percentage of the total acreage planted to sugar cane and the smaller the dependence on other sources of income, the lower were the costs for producing cane and the greater were the total profits from the entire farm business (Appendix Table XVIII). The larger of these farms, averaging from 50 to 150 acres in sugar cane per farm, were efficient enough in the production of sugar cane so that the more they specialized in sugar cane alone, the more they made.

For the many smaller family-type farms, however, a different result is indicated. For such farms, averaging from 2 to 15 acres in sugar cane and from 10 to 30 acres in all crops, the results for each year studied in the 1938-45 period show that the producers in this size group who specialized in sugar cane production alone made lower total returns from the year's work than did those who had other crop enterprises in addition to sugar cane and corn.

In the northern part of the sugar cane belt the enterprises that appeared to be best suited for combining with the cane crop on these small farms were onions, Irish potatoes, and cotton. In the eastern part of the area, strawberries, shallots, and early snap beans were planted most frequently with success in most years by the small growers. In the central part of the cane belt, shallots and early Irish potatoes supplied additional income for the small growers, while in the western area, sweet potatoes, rice, and canning crops such as okra, snap beans, and pepper appeared to be supplementary enterprises to sugar cane on the small family-type farms.

Efficiency in the Use of Labor

Good labor efficiency increases farm returns in all areas. Labor efficiency refers to the amount of productive work accomplished per man working on the farm; in general, the more work accomplished per man, the greater are the farm profits. Efficiency in the use of man labor is especially important in periods of high prices or in areas of high labor costs. Large farms with poor labor efficiency are usually among the least profitable units. The advantages obtained by a large size business can be maintained only by efficient use of all available labor.

On the farms studied, there appeared to be a wide variation in the amount of productive work accomplished per man. The least efficient group produced sugar cane at the rate of from 4 to 6 acres per man, those of medium efficiency had rates of accomplishment of from 8 to 10 acres per man, while the most efficient producers from the standpoint of labor utilization grew and harvested cane at the rate of from 16 to 24 acres per man. In all the years studied, the average labor earnings per farm were about twice as high for the group with medium labor efficiency as compared with the lowest group and were from two to three times as high for the group with the most efficient use of labor as compared with those with medium efficiency (Appendix Table XV).

From the point of view of labor efficiency, the more efficient the use of labor on these farms, the lower were the costs of producing sugar cane. In 1942, for instance, about one-third of the farms studied accomplished productive work at the rate of less than 275 days per man, one-third worked at the rate of 275 to 325 days, and one-third accomplished more than 325 days of productive work per man for the year. The first group had average costs of $5.00 per ton of cane sold, the medium group produced cane for $4.19 per ton, and the high-efficiency group had average costs of $3.20 per ton of cane sold.

These studies indicate that the producers who obtained the highest labor efficiency were those who had relatively large-sized farms so that there was work to be done throughout the year, those who organized and planned their work in advance, and those who had sufficient machinery and equipment of the proper type and size to do each job in the most efficient manner. In addition, there is still another factor associated with labor efficiency which cannot be measured statistically but which was the cause of some of the variations; that is the desire and the inclination to work.

Relation of Superiority in Four Important Factors to Net Returns

The four most important economic factors affecting the costs, returns, and net profits on family-type sugar cane farms have been indicated to be the size of the farm, the yield per acre of sugar cane, the relative intensity of the sugar cane enterprise, and the degree of labor efficiency achieved by the farm operators. In order to test the combined effect of all of these factors on net farm returns, the records for the 1944 season were arranged in five groups: those that were below average in all 4 factors, and those that were above average in 1, 2, 3, or all 4 of the

TABLE 4. Relation of the Combined Effect of Superiority in Size, Yield, Intensity of Cane Enterprise, and Labor Efficiency to Returns from Farming, Louisiana Family-Type Sugar Cane Farms, 1944

	Number of farms	Average labor income per farm
	Number	*Dollars*
Below average in all 4 factors	23	71
Above average in 1 of 4 factors	34	401
Above average in 2 of 4 factors	17	649
Above average in 3 of 4 factors	23	910
Above average in all 4 factors	13	4,642

major points. The average net returns for each of these five groups are presented in Table 4.

The producers who were below average in size of business, yield per acre, diversity of business, and labor efficiency made average labor incomes of $71 per farm in 1944; since 1944 was a relatively favorable year, this return of about $6 per month was very low. The producers who were above average in 1 of the 4 factors had an average labor income of $401; those who were superior in 2 of the 4 points made $649; those who were better than average in 3 of the 4 points had an average labor income of $910; while those who were superior in all factors made $4,642 for the year.

These facts point out the principle that farm profits depend on many factors and that excellence in one will help to increase returns, but a balance of efficiency in all factors is needed to obtain maximum returns from the business.

SUMMARY

1. Detailed farm management and cost studies of the operation of family-type sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station for most of the years since 1938. This report summarizes the results of this series of studies for the 1938 to 1945 period.

2. Records were collected from approximately 500 farmers in 1938, 1940, 1942, and 1945, and about 100 producers in 1941, 1943, and 1944. In most of the years studied, the sample represented between 5 and 10 per cent of all the sugar cane farmers in the area.

3. The average size of the family-type sugar cane farms studied for this period was about 100 acres, including 80 acres in cropland of which 40 acres were planted to sugar cane. An average farm of this size required a total investment in land, buildings, workstock, and equipment of about $12,000.

4. Average yields per acre varied from a high point of 23 tons per acre in 1943 and 1945 to only 14 tons per acre in 1940. Yields on the farms studied were slightly higher in some years than average yields for the state as a whole, but followed the same general trends.

5. The average labor income, or cash profit from sugar cane production to pay the operator for his labor, varied from a high point of around $900 per farm in 1943 and 1944 to a loss of more than $600 per farm in 1940. On the average, these family-type sugar cane producers lost money in two of the six years studied and made peak earnings of from $800 to $900 per farm in three of the six years. On a monthly basis, these farmers made peak cash earnings of $75 per month or $3 per working day in 1943, 1944, and 1945; made $43 per month in 1942, but lost $7 per month in 1938 and $50 per month in 1940.

6. The net cost of producing a ton of sugar cane varied from $3.78 in 1938 to $5.73 in 1945. Adding to these figures the value of the farmer's own labor to obtain a net cost equivalent to the net cost of a business concern, the result was an average cost per ton varying from $4.29 in 1938 to $7.02 in 1945.

7. The farmers surveyed lost from 3 to 24 cents per hour worked in 1938 and 1940 and made cash returns of from 20 to 38 cents per hour from 1942 to 1945. In addition, their non-cash farm privileges amounted to from 12 to 30 cents per hour worked on the farm. Thus, their total returns, including both cash and non-cash items, varied from about 10 cents per hour in 1938 and 1940 to 40 to 68 cents per hour during the 1942-45 period.

8. For the entire period, these family-type sugar cane farmers produced sugar cane at an average cost of $110 per acre, or $5.74 per ton of cane sold, not including the value of the unpaid labor of the farm operator as a cost. Gross income for the period amounted to $121 per acre, or $6.34 per ton. The labor income, or the amount of cash remaining to pay the operator for his year's work on the farm, averaged $434 per farm, $11 per acre of cane produced, or $0.60 per ton of cane sold.

9. The family-type sugar cane farms in the area were typically 4-mule farms, with one-fourth of the farmers owning a tractor, one-third owning a farm truck, and two-thirds operating an automobile for farm and personal use.

10. Workstock costs on the farms studied varied from 14 cents per hour in the 1938-41 period to 26 cents per hour in 1945; tractors were operated at a total cost of 61 cents per hour in 1938 and only 55 cents in 1945; truck expenses varied from less than 6 cents per mile in 1938 to about 8½ cents in 1945; while automobile costs were about 3 cents per mile in 1938 and increased to 5½ cents by 1945.

11. Average man labor requirements for planting, growing, and harvesting one acre of sugar cane amounted to 184 hours for the 1938-45 period. Of this total, 9 per cent were for planting operations, 39 per cent for all growing work, and 52 per cent for harvesting the crop.

12. The financial results of this series of studies of family-type sugar cane farms show that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. The major economic factors influencing net returns were found to be the size of the farm, the yield of cane per acre, the proportion of the cropland planted to cane, and the relative efficiency of the use of man labor.

13. Within the limits of the size of the family-type farms studied, the larger the size of the farm business, the lower were the costs of producing sugar cane and the greater were the profits from the entire farm business. A size of farm of about 100 acres in crops of which 50 acres are in sugar cane is indicated to be needed to maintain the most efficient family-type sugar cane farm.

14. The most important single factor influencing the financial success of the farms studied was the yield per acre of sugar cane. In all years studied, the producers obtaining relatively high yields had lower costs per unit and higher net returns. The facts indicate that in a normal season, the farmer who does not average a 20-ton yield on his entire acreage is also the one who does not make a profit on the enterprise.

15. The larger of the family-type farms, averaging from 50 to 150 acres in sugar cane, were efficient enough in the production of cane so that the more they specialized in sugar cane alone, the more they made. The smaller family-type farms, with from 2 to 15 acres in cane, made greater total returns for the year when they diversified their farm businesses by the addition of other cash crop enterprises and were not completely dependent on the sugar cane crop for all cash income.

16. Relatively high labor efficiency was an important factor in increasing farm returns. The producers who worked at the rate of less than 275 days per year made much lower returns than those who accomplished productive work at the rate of more than 325 days per year. Labor efficiency appeared to be associated with the size of the farm and the efficiency in the use of machinery and workstock.

APPENDIX

TABLE I. AVERAGE COSTS AND RETURNS PER FARM ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938-1945

ITEM	1938	1940	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:						
Cane sold for sugar*	3,075	1,689	3,169	5,407	5,524	4,840
Other crops sold	332	234	399	246	662	617
Livestock and livestock products	81	96	80	70	74	61
Other income	.....	164	163	209	177	303
Total receipts	3,488	2,183	3,811	5,932	6,437	5,821
Farm Expenses:						
Hired labor	1,545	1,008	1,202	2,288	2,244	1,797
Unpaid labor†	208	215	266	340	312	286
Fertilizer	131	140	151	235	280	218
Feed, seeds, and plants	79	100	108	145	141	97
Machinery and building costs	280	270	332	445	542	611
Land rent[1]	283	195	354	574	585	585
Interest[1]	410	418	364	494	669	568
All other expenses	633	440	517	497	693	777
Total expenses	3,569	2,786	3,294	5,018	5,466	4,939
Income:						
Labor income	− 81	−603	517	914	971	882
Value of farm privileges	321	343	510	530	763	696
Labor earnings	240	−260	1,027	1,444	1,734	1,578
Value of operator's time	430	550	654	671	1,105	893
Return to capital	−111	−735	+227	+637	+535	+557
Capital investment	8,200	8,360	7,280	9,880	13,380	11,360

*Total receipts from cane sold, including government payments.

†Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

[1] Includes rent at actual cost and interest on owned investment at 5 per cent of the depreciated assets.

TABLE II. COSTS AND RETURNS PER ACRE OF CANE GROWN ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

COSTS AND RETURNS PER ACRE	1938	1940	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Direct farm expenses	70.15	62.09	73.60	89.77	100.29	118.31
Rent and interest	16.90	17.51	20.51	24.27	29.86	36.03
Total farm expenses	87.05	79.60	94.11	114.04	130.15	154.34
Receipts from sources other than sugar cane	10.07	14.11	18.34	11.93	21.74	30.66
Net cost of producing sugar cane	76.98	65.49	75.77	102.11	108.41	123.68
Total returns from cane sold	75.00	48.26	90.54	122.89	131.52	151.25
Profit from sugar cane to pay operator for his labor	− 1.98	−17.23	14.77	20.78	23.11	27.57
Value of farm privileges	7.83	9.80	14.57	12.05	18.16	21.75
Total cash and non-cash profits from sugar cane	5.85	− 7.43	29.34	32.83	41.27	49.32
Value of operator labor	10.49	15.71	18.68	15.25	26.31	27.91
Net gain over value of operator labor	− 4.64	−23.14	10.66	17.58	14.96	21.41
Acres of cane per farm	41	35	35	44	42	32

TABLE III. Costs and Returns per Ton of Cane Sold for Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945

Costs and returns per ton sold	1938	1940	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Direct farm expenses	3.44	4.72	4.26	4.22	4.89	5.48
Rent and interest	.83	1.33	1.19	1.14	1.46	1.67
Total farm expenses	4.27	6.05	5.45	5.36	6.35	7.15
Receipts from sources other than sugar cane	.49	1.14	1.06	.56	1.06	1.42
Net cost of producing sugar cane	3.78	4.91	4.39	4.80	5.29	5.73
Total returns from cane sold	3.68	3.67	5.24	5.77	6.41	7.00
Profit from sugar cane to pay operator for his labor	– .10	– 1.24	.85	.97	1.12	1.27
Value of farm privileges	.38	.74	.84	.57	.88	1.00
Total cash and non-cash profits from sugar cane	.28	– .50	1.69	1.54	2.00	2.27
Value of operator labor	.51	1.20	1.08	.72	1.28	1.29
Capital investment per ton	9.82	18.17	12.03	10.54	15.90	16.44
Tons of cane produced per farm	890	521	661	1,005	890	727
Tons of cane sold per farm	835	460	605	937	861	691

TABLE IV. Average Labor Returns to the Operator from the Sugar Cane Enterprise for Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945

Costs and returns	1938	1940	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Costs and returns per farm:						
Income from sugar cane	3,075	1,689	3,169	5,407	5,524	4,840
Net costs	3,156	2,292	2,652	4,493	4,553	3,958
Cash profit to pay farmer for his labor	– 81	– 603	517	914	971	882
Value of farm privileges	321	343	510	530	763	696
Total profit to pay farmer for his labor	240	– 260	1,027	1,444	1,734	1,578
Costs and returns per hour:						
Cash return per hour of labor*	– .03	– .24	.20	.36	.38	.35
Non-cash return per hour of labor*	.12	.14	.20	.21	.30	.27
Total return per hour of labor*	.09	.10	.40	.56	.68	.62
Farmer's estimate of value per hour of his labor	.17	.22	.26	.26	.43	.35
Minimum wage rate in the area†	.15	.15	.18	.23	.25	.27

*Based on an average of 10.1 months of 25 working days of full-time work on the farm as reported by the farmers surveyed, or a total of 2,550 hours of work for the year.

†Average of hourly rate as established by the U.S. Department of Agriculture, for each year for common male labor, with harvesting rates weighted at 30 per cent and cultivating rates at 70 per cent.

TABLE V. Tenure of Farm Operators Surveyed, Family-Type Louisiana Sugar Cane Farms, 1938-45

	1938	1940	1942	1943	1944	1945
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Farms in each tenure group						
Full owners	165	128	115	29	39	222
Part owners and renters	156	155	123	43	29	66
Cash renters	80	69	110	12	25	106
Share renters	99	101	119	26	17	113
Total	500	453	467	110	110	507
Proportion in each group	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Full owners	33	28	25	26	35	44
Part owners and renters	31	34	26	39	26	13
Cash renters	16	15	24	11	23	21
Share renters	20	23	25	24	16	22
Total	100	100	100	100	100	100

TABLE VI. Livestock and Equipment on Family-Type Louisiana Sugar Cane Farms, 1942

Item	Proportion of all farms having the item	Number per farm reporting the item	Average value per item
	Per cent	*Number*	*Dollars*
Livestock:			
Mules	100	4	173
Milk cows	72	4	61
Other cattle	38	6	44
All hogs	86	7	113
Chickens	92	82	1
Power Equipment:			
Tractors	26	1	1,298
Trucks	30	1	558
Automobiles for farm use	60	1	446
Other Equipment:			
Diggers, cane	16	1	45
Disc harrows	44	1	52
Feed grinders	20	1	25
Fertilizer distributors	26	1	27
Hand hoes	100	6	1
Hoist and derrick	16	1	423
Knives, cane	100	11	1
Listers	38	1	56
Middle busters	52	1	15
Mowers	57	1	58
Planters	77	1	20
Plows, double	48	1	16
Plows, single	100	3	14
Riding cultivators	64	1	68
Saddles	38	1	17
Shavers, cane	51	1	28
Spike harrows	100	2	8
Wagons	100	2	115
Walking cultivators	82	1	31
Work gears	100	4	37

TABLE VII. DISTRIBUTION OF CAPITAL INVESTMENT ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1942 AND 1945

CAPITAL ITEMS	AVERAGE INVESTMENT PER FARM			
	Owners		Renters	
	1942	1945	1942	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*
Land	5,643	9,299	......	......
Buildings	3,428	4,333	......	......
Total real estate	9,071	13,632	......	......
Workstock	747	822	520	644
Cattle	318	350	155	187
Other livestock	214	232	105	134
Total livestock	1,279	1,404	780	965
Tractors	537	860	14	488
Trucks	231	213	5	110
Farm automobiles*	372	250	169	130
Other equipment	862	1,115	271	770
Total machinery and equipment	2,002	2,438	459	1,498
Total investment	12,352	17,474	1,239	2,463

*Includes value of the farm share only.

TABLE VIII. COST OF MULE WORK ON LOUISIANA FAMILY-TYPE SUGAR CANE FARMS, 1938-1945*

COST PER MULE	1938	1940	1941	1942	1943	1944	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Grain, 2 tons	50	60	60	74	88	120	126
Hay, 3 tons	30	27	24	28	39	51	54
1 acre of pasture	5	5	5	5	6	6	6
Man labor, 114 hours	17	17	17	21	26	28	31
Depreciation[1]	19	19	19	19	19	19	19
Interest[2]	4	4	4	4	4	4	4
Shoeing	4	4	4	4	5	5	5
Veterinary and medicine	1	1	1	1	2	2	2
Use of buildings	1	1	1	1	1	1	1
Harness costs	5	5	5	6	6	7	7
Total cost for year	136	143	140	163	196	243	255
Cost per hour[3]	14c	14c	14c	16c	20c	24c	26c

*Based on special physical requirements studies made in 1938 and 1941 and actual prices paid per unit for each year.

[1] Established on an average cost per mule of $150 and an average 8-year useful life.

[2] Interest on average value of $75 per mule at 5 per cent.

[3] Based on an average use of 1,000 hours per year.

TABLE IX. COST OF TRACTOR WORK ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

COSTS	1938	1940	1942	1945
	Dollars	*Dollars*	*Dollars*	*Dollars*
Cost per day of use (9 hours)				
Fuel oil and gasoline	1.82	1.82	1.85	1.57
Lubricating oil and grease	.50	.28	.30	.38
Repairs	.19	.52	.50	.85
Other cash costs	.37	.09	.17	.28
Total operating expenses	2.88	2.71	2.82	3.08
Depreciation	1.98	1.76	.74	1.37
Interest	.66	.45	.44	.47
Total overhead expenses	2.64	2.21	1.18	1.84
Total Costs	5.52	4.92	4.00	4.92
Operating costs per hour	.32	.30	.31	.34
Overhead costs per hour	.29	.25	.14	.21
Total costs per hour	.61	.55	.45	.55
Number of tractors studied	85	101	123	176
9-hour days of use per tractor	81.9	103.4	148.8	179.4
Average value per tractor, dollars	1079	939	1298	1664

TABLE X. COSTS OF OPERATING FARM TRUCKS ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA, 1938 TO 1945

COSTS	1938	1940	1942	1945
	Cents	*Cents*	*Cents*	*Cents*
Costs Per Mile of Use				
Gasoline	1.90	1.68	1.96	1.90
Oil	.25	.22	.26	.31
Repairs	.58	.63	.74	2.30
Tires	.47	.22	.46	1.58
Insurance	.18	.30	.26	.22
License	.45	.37	.16	.15
Total Operating costs	3.83	3.42	3.84	6.46
Depreciation	1.59	2.80	1.49	1.44
Interest	.32	.70	.46	.56
Total Overhead costs	1.91	3.50	1.95	2.00
Total costs	5.74	6.92	5.79	8.46
Number of trucks studied	78	129	142	121
Miles of use per year	5578	4126	6056	6085
Average value per truck, dollars	361	580	558	679

TABLE XI. Costs of Operating Farm Automobiles on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945

Costs	1938	1940	1942	1945
	Cents	*Cents*	*Cents*	*Cents*
Costs per Mile of Use				
Gasoline	1.19	1.19	1.18	1.35
Oil	.16	.15	.12	.31
Repairs	.25	.35	.74	1.46
Tires	.24	.25	.15	.80
Insurance	.06	.10	.07	.05
License	.16	.19	.06	.06
Total operating costs	2.06	2.23	2.32	4.03
Depreciation	.68	1.49	1.44	.94
Interest	.25	.33	.42	.50
Total overhead costs	.93	2.82	1.86	1.44
Total costs	2.99	5.05	4.18	5.47
Number of automobiles studied	281	270	279	255
Miles of use per year	7720	6332	5330	5509
Average value per car, dollars	380	420	446	548
Per cent of use for farm	55	48	83	62

TABLE XII. Total Labor Requirements for Planting, Growing, and Harvesting Sugar Cane on Family-Type Sugar Cane Farms in Louisiana*

Operation	Average per acre harvested	
	Man hours	Mule hours
Planting one-half acre	17.0	15.0
All growing operations for 1 acre	71.1	67.8
All harvesting operations for 1 acre with 20 ton average yield	96.0	17.0
Total per acre for the year	184.1	99.8

*Based on records obtained from 498 farmers in 1938, 453 in 1940, 179 in 1941, and 467 in 1942.

TABLE XIII. Average Labor Requirements for Planting Sugar Cane on Family-Type Farms in Louisiana*

Operation	Average per acre planted	
	Man hours	Mule hours
Roguing cane to be used for seed	1.0	....
Plowing rows, 6 furrows	9.0	18.0
Opening furrow for seed cane	1.2	2.4
Cut and strip 3.5 tons of seed cane	12.2	....
Loading, hauling, and dropping cane	5.5	3.7
Cutting and straightening cane in furrow	1.5	....
Covering	1.2	2.4
Rolling	0.6	1.2
Opening quarter drains	1.8	1.8
Total	34.0	29.5

*Based on records obtained from 498 farmers in 1938, 453 in 1940, 179 in 1941, and 467 in 1942.

TABLE XIV. AVERAGE LABOR REQUIREMENTS FOR CULTIVATING AND HARVESTING SUGAR CANE ON FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA*

OPERATION	AVERAGE PER ACRE	
	Man hours	Mule hours
Growing:		
Barring-off, cultivating, and laying-by, 20 trips down each row	30.0	60.0
Fertilizing	2.7	.3
Hoeing	24.5	....
Opening quarter drains, 9 times	7.5	7.5
Plugging-out lateral drainage ditches	3.8	....
Cutting grass in ditches and on ditch banks	2.5	....
Total growing	71.0	67.8
Harvesting:		
Cut and strip 20 tons of cane	70.0	....
Loading, hauling, and unloading at derrick	26.0	17.0
Total harvesting	96.0	17.0
Total growing and harvesting for the year	167.0	84.8

*Based on records obtained from 498 farmers in 1938, 453 in 1940, 179 in 1941, and 467 in 1942.

TABLE XV. RELATION OF ACRES OF CANE PER MAN TO COSTS AND RETURNS FOR FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA

COSTS AND RETURNS PER FARM	ACRES PER MAN, 1942			ACRES PER MAN, 1944		
	Low	Medium	High	Low	Medium	High
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:						
Sugar cane	1,392	3,467	5,977	1,656	3,750	11,061
All other income	801	565	547	992	1,125	623
Total receipts	2,193	4,032	6,524	2,648	4,875	11,684
Farm Expenses:						
Hired labor	557	1,305	1,786	694	2,074	3,921
Other direct costs	1,112	1,330	2,010	1,475	1,558	4,132
Total direct costs	1,669	2,635	3,796	2,169	3,632	8,053
Rent costs	141	371	662	100	120	249
Farm income	+ 383	+1,026	+2,066	+ 379	+1,123	+ 3,382
Interest	264	403	576	295	520	1,181
Labor income	+ 119	+ 623	+1,490	+ 84	+ 603	+ 2,201
Farm privileges	473	521	552	678	676	934
Labor earnings	+ 592	+1,144	+2,042	+ 762	+1,279	+ 3,135
Acres of cane per farm	14	35	66	11	26	88
Acres of cane per man	6	10	16	4	8	24
Tons of cane per acre	18	18	17	23	22	21
Tons of cane sold per farm	260	632	1,101	267	606	1,782
Number of farms	192	150	125	36	37	37

TABLE XVI. RELATION OF SIZE OF FARM TO COSTS AND RETURNS FOR FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA

COSTS AND RETURNS PER FARM	1940			1942			1944		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:									
Sugar cane	502	1,402	4,484	868	2,770	8,582	1,344	4,720	13,823
All other income	294	389	1,231	483	486	1,163	973	552	1,166
Total receipts	796	1,791	5,715	1,351	3,256	9,745	2,317	5,272	14,989
Farm Expenses:									
Hired labor	231	694	3,057	243	837	3,155	592	2,110	4,949
All other costs	517	1,004	2,827	662	1,287	3,060	1,042	1,975	5,637
Total direct costs	748	1,698	5,884	905	2,124	6,215	1,634	4,085	10,586
Rent costs	93	183	435	114	278	903	77	142	314
Farm income	− 45	− 90	− 604	+ 332	+ 854	+2,627	+ 606	+1,045	+4,089
Interest	166	342	1,050	168	349	882	261	605	1,465
Labor income	− 211	− 432	−1,654	+ 164	+ 505	+1,745	+ 345	+ 440	+2,624
Farm privileges	273	374	465	419	577	626	600	791	1,029
Labor earnings	+ 62	− 58	−1,189	+ 583	+1,082	+2,371	+ 945	+1,231	+3,653
Acres of cane per farm	11	28	96	10	28	89	10	33	108
Yield per acre of cane, tons	14	15	14	17	18	18	22	23	21
Tons of cane sold per farm	152	430	1,380	160	506	1,584	217	760	2,227
Number of farms	234	113	106	237	111	119	52	29	29

TABLE XVII. Relation of Yield per Acre of Sugar Cane to Costs and Returns per Family-Type Sugar Cane Farm in Louisiana

Costs and Returns per Farm	1940			1942			1944		
	Low yield	Medium yield	High yield	Low yield	Medium yield	High yield	Low yield	Medium yield	High yield
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:									
Sugar cane	1,033	2,113	2,067	1,519	2,916	5,099	4,862	5,730	6,147
All other income	396	597	691	390	543	987	970	701	1,097
Total receipts	1,429	2,710	2,758	1,909	3,459	6,086	5,832	6,431	7,244
Farm Expenses:									
Hired labor	718	1,340	1,106	472	1,078	1,713	2,096	2,204	2,487
Other direct costs	449	1,367	1,223	976	1,212	1,993	2,722	1,941	2,524
Total direct costs	1,167	2,707	2,329	1,448	2,290	3,706	4,818	4,145	5,011
Rent costs	152	239	215	206	298	531	100	125	271
Farm income	− 490	− 236	+ 214	+ 255	+ 871	+1,851	+ 914	+2,161	+1,962
Interest	357	485	436	225	348	573	721	565	327
Labor incomes	− 847	− 721	− 222	+ 30	+ 523	+1,278	+ 193	+1,596	+1,635
Farm privileges	333	357	346	494	487	543	734	716	859
Labor earnings	− 514	− 364	+ 124	+ 524	+1,010	+1,821	+ 927	+2,312	+2,594
Acres of cane per farm	34	42	30	25	33	44	48	41	35
Yield per acre of cane, tons	10	15	20	12	17	21	16	22	29
Tons of cane sold per farm	337	639	617	280	536	940	782	924	992
Number of farms	184	116	153	139	160	168	41	38	31

TABLE XVIII. RELATION OF PROPORTION OF CROP LAND IN SUGAR CANE TO COSTS AND RETURNS FOR FAMILY-TYPE SUGAR CANE FARMS IN LOUISIANA

COSTS AND RETURNS PER FARM	PER CENT CROP LAND IN CANE, 1940			PER CENT CROP LAND IN CANE, 1942			PER CENT CROP LAND IN CANE, 1944		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Farm Receipts:									
Sugar cane	773	1,029	2,671	851	1,358	4,986	1,582	4,632	10,746
All other income	692	348	552	1,150	588	514	1,547	502	596
Total receipts	1,465	1,377	3,223	2,001	1,946	5,500	3,129	5,134	11,342
Farm Expenses:									
Hired labor	558	597	1,591	364	389	1,717	1,035	2,071	3,750
All other direct costs	895	855	1,562	1,016	932	1,781	1,376	1,917	3,981
Total direct costs	1,453	1,452	3,153	1,380	1,321	3,493	2,411	3,988	7,731
Rent costs	147	153	258	125	195	504	126	76	268
Farm income	− 135	− 228	− 188	+ 496	+ 430	+1,498	+ 592	+1,070	+3,343
Interest	324	316	549	240	208	526	293	686	1,070
Labor income	− 459	− 544	− 737	+ 256	+ 222	+ 972	+ 299	+ 384	+2,273
Farm privileges	321	326	370	426	476	554	607	797	905
Labor earnings	− 138	− 218	− 367	+ 682	+ 698	+1,526	+ 906	+1,181	+3,178
Acres of cane per farm	17	24	55	9	16	52	11	36	81
Per cent of crop land in cane	17	24	55	21	35	55	24	45	62
Yield per acre of cane, tons	14	14	15	17	16	18	21	22	22
Tons cane sold per farm	360	440	890	157	250	918	256	745	1,731
Number of farms	118	143	192	92	114	261	40	34	36

TECHNOLOGY AND SCIENCE ROOM

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AN ANALYSIS OF CHANGES IN SWEET POTATO PRICES

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LOUISIANA STATE UNIVERSITY

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AN ANALYSIS OF CHANGES IN SWEET POTATO PRICES

M. E. Miller and M. D. Woodin

This report presents an analysis of how and why the farm price of sweet potatoes in Louisiana has changed in the past, and provides a basis for determining what changes might be expected under similar conditions in the future.

Commercial sweet potato growers, shippers, and agricultural workers are interested in several types of changes in sweet potato prices. First, they are concerned with long-time price changes, which indicate trends in the industry. The long-time price outlook is significant in deciding whether to build a storage house, and in making other decisions where fixed investments are involved.

Second, there are year-to-year price changes, which largely determine the profitableness of individual crops. The sweet potato price outlook for a year ahead is important in deciding whether to increase or decrease sweet potato acreage, and in making other plans for the current year's operations.

A third type of change is the movement of prices during the marketing season. These changes have an important bearing on when to dig the crop, when to sell and what price to accept, and whether to store sweet potatoes and for how long.

Long-Time Price Changes

Sweet potato prices have fluctuated widely during the past 38 years, ranging from $1.80 per bushel in 1924 to a low of 42 cents in 1932 (Figure 1).[1] There have been three periods of very high prices, namely, World War I, the middle 1920's, and World War II. During periods of war all prices rise, and sweet potatoes followed this movement during both wars. Sweet potato prices were high in 1923 to 1925 primarily because of short crops. During the 1930's sweet potatoes averaged 65 cents per bushel, compared with $1.28 from 1940 to 1946.

These large changes in price over a period of years are closely associated with changes in the general level of prices of all farm commodities. Figure 2 shows the movements in sweet potato prices and the index of prices of all farm products in the United States for the period 1930-46.[2] Both the price level and sweet potato prices fell to low levels in the early 1930's, recovered by 1936, declined with the 1937 business recession, then began a sharp upward trend as the war approached.

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[1] Farm price of sweet potatoes is used in this analysis because of its availability from U.S.D.A. publications. Farm price is the price received by growers at the farm or at the first point of sale, and is based on all grades sold, including No. 1's, 2's, etc.

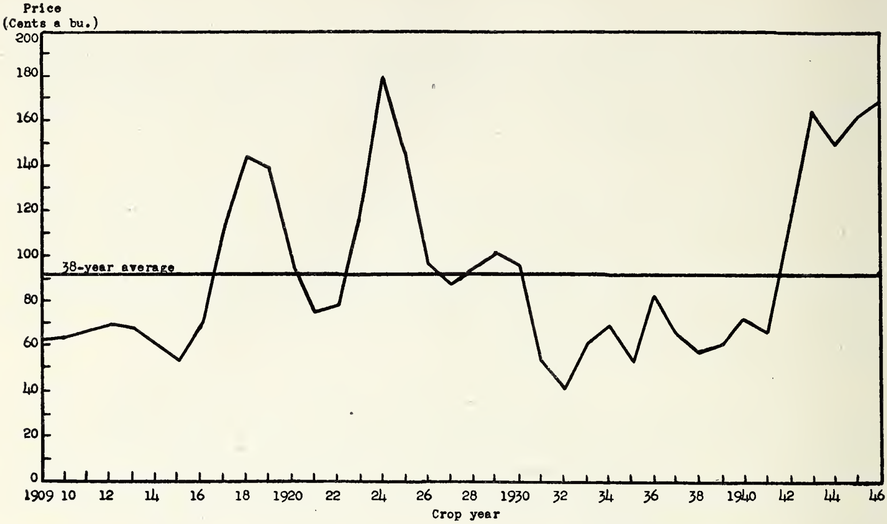

FIG. 1 — FARM PRICE OF LOUISIANA SWEET POTATOES, 1909-46

(October to March monthly average)

The farm price of sweet potatoes averaged 93 cents a bushel during the 38-year period 1909-46. Prices varied widely from year to year, reaching high levels in World Wars I and II and in the middle 1920's. The price during the 1930's averaged 65 cents compared with $1.28 from 1940 to 1946. The post-war adjustments that took place after World War I have not yet occurred after World War II, although there were indications in the spring of 1947 that these expected adjustments had begun.

Sweet potato prices are also affected by factors other than changes in consumer purchasing power, such as the size of the sweet potato crop; therefore prices change oftener and sometimes more drastically than consumer purchasing power.

In the future it can be expected that sweet potato prices will continue to follow the general movements of the prices of all farm commodities, which reflect changes in consumer purchasing power. If the all-farm-commodity price level declines during the next few years, as is generally predicted, sweet potato prices also are likely to fall from the present high levels. A return to the 60- to 70-cent level of pre-war years would not be an unreasonable expectation.

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[2] The period beginning with 1930 is used in this analysis because it is a period of great price changes and a time when the commercial sweet potato industry in Louisiana had become a large business. The index of prices of all farm products in the U. S. is used here to represent consumer purchasing power because when consumer purchasing power rises or falls the general level of farm commodity prices generally moves in the same direction. Individual products, such as sweet potatoes, usually follow these over-all price movements.

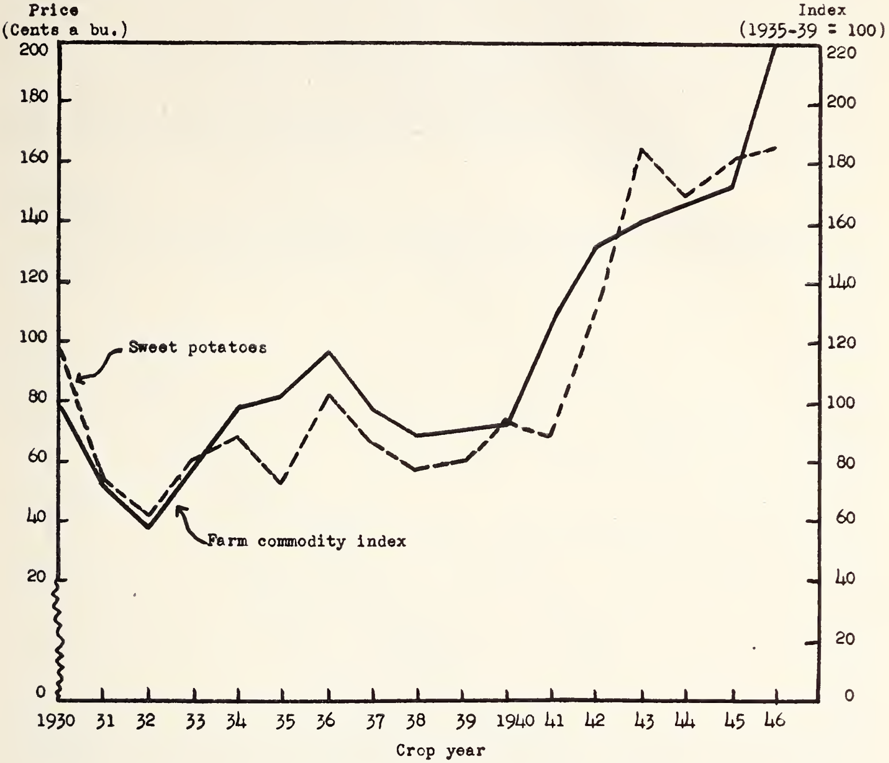

Fig. 2 — Relation of Louisiana Farm Price of Sweet Potatoes to Index of Prices of Farm Commodities in U. S., 1930-46

Sweet potato prices have followed the general movements of all farm commodity prices, but often fluctuate more from year to year. Both sweet potato and all commodity prices rose rapidly during the war period beginning in 1941. In 1946 commodity prices continued sharply upward while sweet potatoes did not change greatly. A decline in commodity prices is expected by most economists. Sweet potato prices are likely to move downward also. Sweet potato price movements in the spring of 1947 indicate that this period of post-war readjustment may have begun.

Year-to-Year Price Changes

As pointed out above, changes in the purchasing power of consumers, which affects all prices, is the most important factor affecting the level of sweet potato prices over a period of years. Prices for any one season may vary widely from this long-time level. Changes in the size of the crop are largely responsible for these year-to-year variations.

In Figure 3 is shown the year-to-year relationship between sweet potato production and sweet potato prices after adjustment has been made for the influence of changes in consumer purchasing power on price.[3] Normally an increase in the size of the crop over the previous year resulted in a lower purchasing power price. Conversely, a decrease in production was accompanied by an increase in the purchasing power price. From 1943 to 1945 this relationship did not hold true. Apparently, the abnormal wartime demand for sweet potatoes changed the normal supply-price relationship.

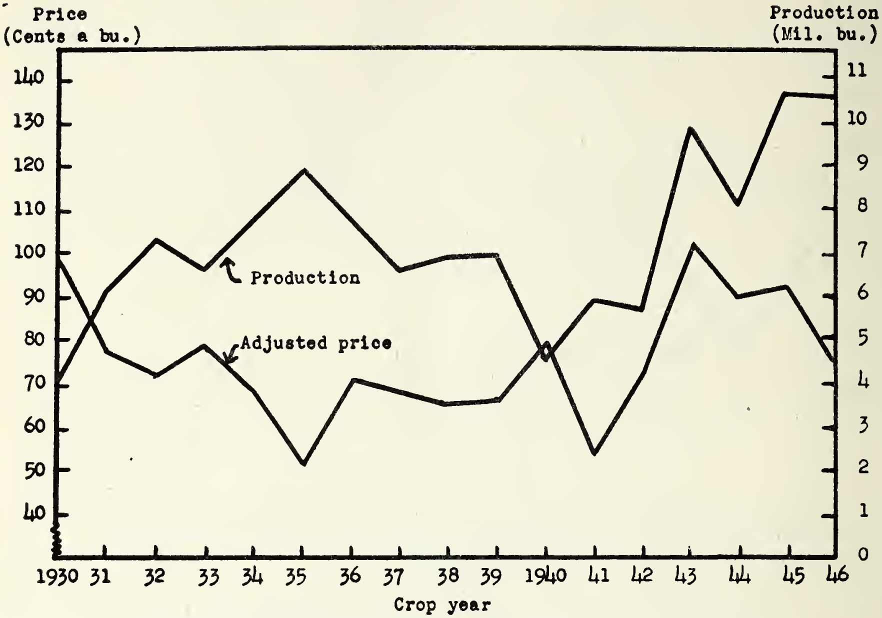

Fig. 3 — Production and Adjusted Farm Price of Sweet Potatoes in Louisiana, 1930-46

("Adjusted price" is actual price with the effect of changes in the general price level removed.)

Price normally varies inversely with the size of the crop. Since 1942 this relationship has not existed, mainly because of abnormal economic conditions caused by wartime maladjustments.

According to the average relationship between changes in production and adjusted prices during the period 1930-42, when production increased 10 per cent over the previous year, price (after adjustment for price level) decreased 7 per cent (Figure 4). And when production decreased 10 per cent, prices increased 9 per cent. Stated another way, on the basis of an average crop of 6.6 million bushels and an average price of 71 cents a bushel during the period 1930-42, an increase of 1 million bushels from the previous year was accompanied by a price decrease of about 7 cents a bushel, but a crop decrease of 1 million bushels was accompanied by a price increase of 10 cents a bushel. This suggests that larger-than-average crops are more valuable to the industry than below-average crops because increases in production are not fully offset by price decreases, whereas reductions in the crop are not fully compensated for by price increases. Crops 20 per cent above average during the 1930-42 period had a purchasing power value 102 per cent of average, while crops 20 per cent below average had a value of less than 94 per cent of average.

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[3] The influence of changes in consumer purchasing power on sweet potato prices is removed by dividing the actual sweet potato price by the index of farm commodity prices in the U. S. The result is an "adjusted" or "purchasing power" price of sweet potatoes.

While the line in Figure 4 shows the average relationship between production and price changes, it does not represent some of the years accurately, as evidenced by the scatter of individual years about the

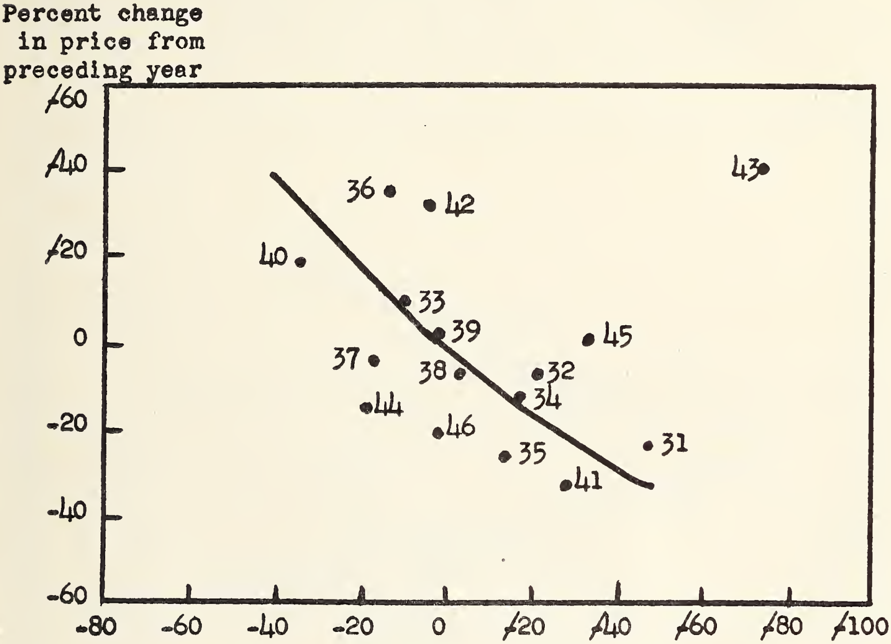

FIG. 4 — RELATION OF CHANGES IN ADJUSTED FARM PRICE OF SWEET POTATOES TO CHANGES IN PRODUCTION, LOUISIANA, 1930-46

(Line is based on 1930-42 period. Price adjusted for general price level conditions. Numbers opposite dots designate the crop year. For example, the 1940 dot indicates a crop 34 per cent smaller and a price 20 per cent larger than in 1939.)

According to the line of average relationship, an increase of 10 per cent in the size of the crop has been accompanied by a 7 per cent decrease in price, and a 10 per cent decrease in crop by a 9 per cent increase in price. This indicates that large crops tend to be more valuable to the industry than small crops. The war years do not conform to the pre-war pattern of relationship, and any predictions of future sweet potato prices based on size of crop and general commodity price level are likely to be unreliable so long as the present abnormal conditions continue.

line. The crops of 1943, 1944, and 1945 do not conform at all to the normal relationship for the 1930-42 period. In 1943 a crop 76 per cent greater than the previous year sold for a price 42 per cent greater than the previous year. In 1945 a somewhat similiar situation occurred. But in 1944 a smaller crop sold for considerably less than the general supply-price relationship would indicate.

It is expected that the pre-war relationship between production and price changes will again prevail after adjustments from abnormal wartime economic conditions have taken place.

Comparison of Actual and Estimated Sweet Potato Prices

As shown previously, the price received by Louisiana sweet potato growers is largely determined in normal years by two factors, namely, the size of the Louisiana sweet potato crop and the price level of all

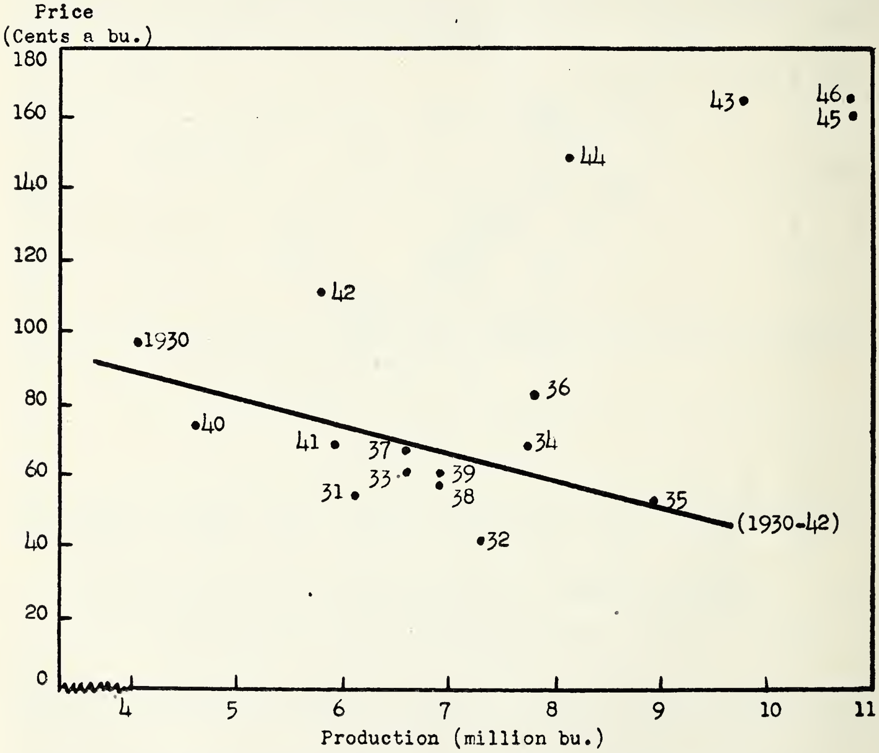

Fig. 5 — Production and Farm Price of Sweet Potatoes in Louisiana, 1930-46 (Price not adjusted for general price level conditions. Numbers opposite dots designate the crop year.)

Prices received by growers tend to be lower when crops are large, but the relationship is not consistent. Other factors, mainly consumer purchasing power, obscure the normal supply-price relationship; therefore price cannot be estimated accurately from production alone.

farm commodities (consumer purchasing power). The extent to which annual price changes are explained by these two factors is shown in Figures 5, 6, and 7. Estimated prices are based on production and price level changes for the 1930-42 period. The war years are shown to indicate their wide variance from the pre-war normal relationships, but are not included in the analysis.

In Figure 5, the sloping line represents the relationship between sweet potato production and actual prices received by growers. An estimate of price for any year based on production alone would likely be considerably in error. For instance, a crop of about 6 million bushels in 1942 sold for 35 cents more than the line would indicate, while a crop of similar size in 1931 sold for nearly 20 cents less than estimated from

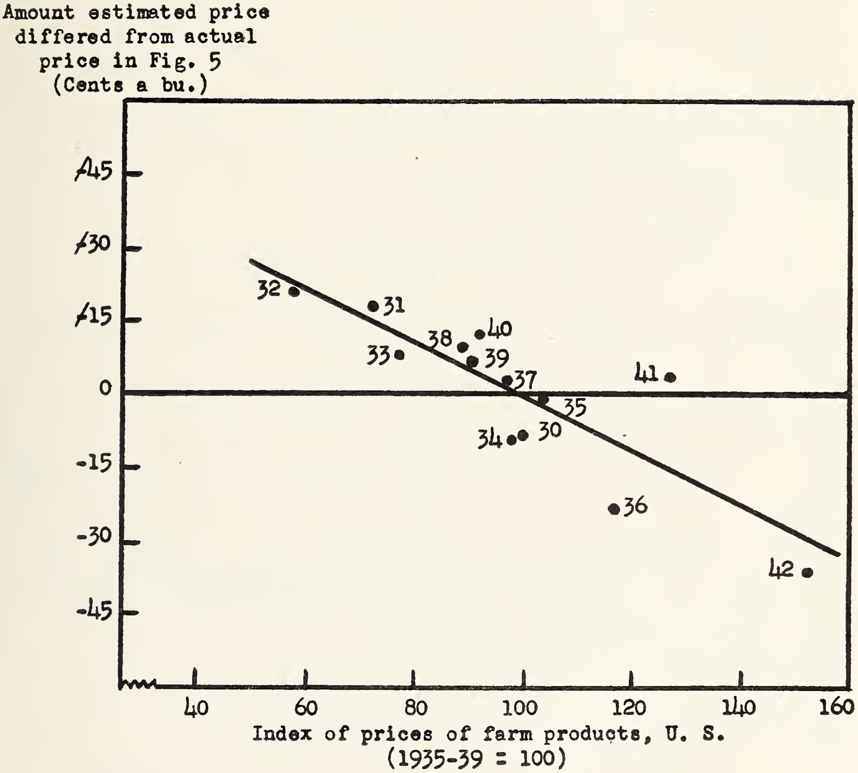

Fig. 6. — Relation of Farm Product Price Level to Differences Between Actual Sweet Potato Prices and Estimated Prices Based on Size of Crop, 1930-42

(Index of farm prices in U. S. is used here to represent consumer purchasing power. Numbers opposite dots designate the crop year. Differences between actual and estimated prices are from Figure 5. For example in 1942 the actual price of sweet potatoes was $1.12, but the estimated price based on the line of average relationship in Figure 5 was 76 cents, 36 cents lower. This difference is plotted against the U. S. index of farm prices in the figure above.)

When the index of farm product prices is low, there is a tendency for sweet potato price estimates which are based on production alone to be higher than actual sweet potato prices.

the line of average relationship. Obviously, factors other than the size of the crop caused these variations.

To determine the influence of the general farm price level on sweet potato prices, the differences between actual prices shown by the dots in Figure 5 and the price estimated from the sloping line were tabulated. For example, in Figure 5, a crop of 7.3 million bushels in 1932 sold for an average price of 42 cents per bushel, but according to the line of average relationship a crop of this size should have brought 63 cents a bushel, a difference between actual and estimated price of 21 cents. These differences were plotted against the index of prices of all farm commodities in the U. S. The differences, which are shown by the dots in Figure 6, are grouped along the line of relationship. In other words, changes in the price level of all farm commodities explains, or is associated with, most of the errors in price estimates based on sweet potato production alone. Therefore, sweet potato production in Louisiana and the general level of consumer purchasing power (represented here by the all-farm-commodity price index) accounted for practically all of the year-to-year changes in the prices received by Louisiana sweet potato growers during the 1930-42 period.

The closeness of price estimates based on these two factors to

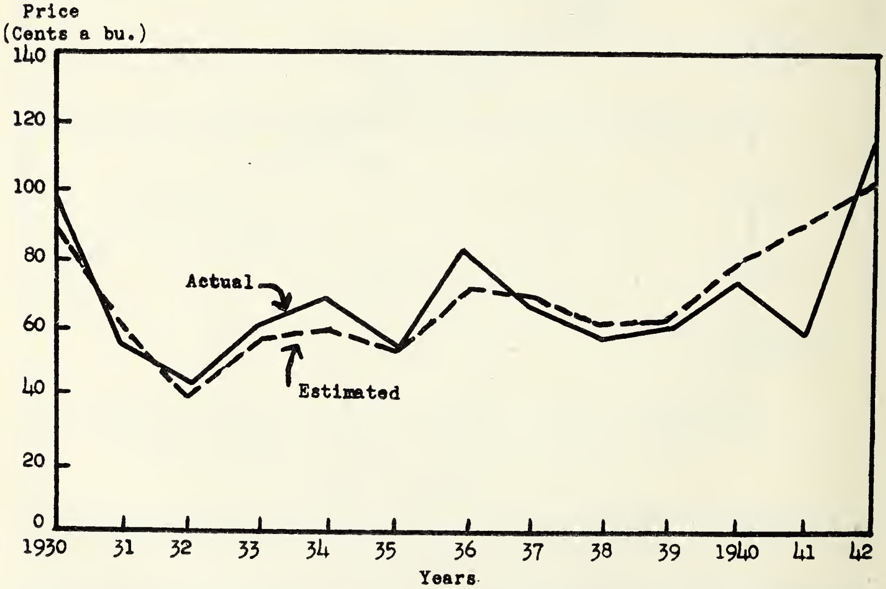

Fig. 7. — Actual and Estimated Farm Price of Louisiana Sweet Potatoes, 1930-42
(Estimates based on size of crop and price level of farm commodities.)

Over the 13-year period actual and estimated prices averaged the same The greatest difference occurred in 1941. Price estimates based on size of crop and price level have not been reliable under the abnormal economic conditions existing since 1942.

actual average prices received by growers is shown in Figure 7. Over the 13-year period, the average of the estimated prices was exactly the same as the average of the actual prices. In most of these years errors in estimate amounted to less than 5 cents a bushel. The greatest difference occurred in 1941, a year of rapidly rising consumer incomes and a relatively small crop, when sweet potato prices declined instead of rising as would normally be expected under such conditions. Price estimates based on production and price level have not been accurate during the unusual economic conditions existing since 1942. With a return to economic normalcy these two factors are again likely to be the main factors causing sweet potato prices to change from one crop season to the next.

Other Factors Affecting Long-Time and Year-to-Year Changes in Sweet Potato Prices

Factors other than size of crop and price level no doubt have some effect on the level and movement of sweet potato prices. For example, the industry-wide advertising program in Louisiana has done much to bring Louisiana sweet potatoes to the attention of consumers in the large markets of the country. The promotional activities of progressive shippers in developing new markets and expanding established ones likewise has stimulated demand for Louisiana sweet potatoes and affected prices received by growers. The true effect of advertising and promotional work on prices is difficult to measure. One indication of the effect of these factors is the fact that commercial sweet potato production in Louisiana has increased greatly during the past 20 years and there has been no noticeable downward trend in prices.

In recent years, important new areas in the state have begun to produce large quantities of sweet potatoes for market. It is entirely possible that production will reach higher levels in the future than was attained in prewar years, unless sweet potato acreage declines in those areas having heaviest weevil infestation. Prevalence of weevil, quarantine restrictions, lower sweet potato prices in 1946-47, and a favorable cotton-price outlook for 1947 may result in reduction in sweet potato acreage and production in some areas of South Louisiana.

Another factor that may have some effect on Louisiana sweet potato prices from year to year is the size of the sweet potato crop in other producing areas, such as the New Jersey-Delaware-Maryland area. But judging from the accuracy with which Louisiana prices could be determined in the 1930-42 period by considering only Louisiana production and the general price level of farm commodities, the importance of the size of the crop in competing areas on prices received by Louisiana growers apparently is not very great. If commercial production of the moist-type sweet potato in other states increases to any great extent, it may become an important factor affecting Louisiana prices.

Some observers are of the opinion that Irish potatoes compete with sweet potatoes for the consumer's food dollar, and the size of the Irish potato crop is a very important factor causing sweet potato prices to change from year to year.[4] When the unexplained differences between actual and estimated sweet potato prices shown in Figure 7 were plotted against Irish potato production, no consistent relationship appeared, suggesting that Irish potatoes do not compete directly with sweet potatoes, at least not to such an extent that sweet potato prices are affected noticeably in years of large or small Irish potato crops. Abrahamsen, in a study of consumer preferences for sweet potatoes, found that about two-thirds of the consumers interviewed thought that sweet potatoes replaced other items of food, but of the foods replaced, Irish potatoes ranked lower than bread.[5]

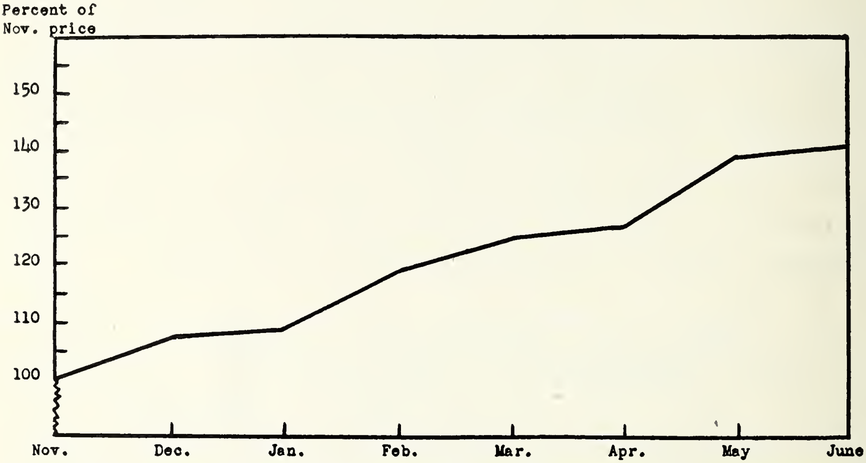

FIG. 8. — SEASONAL INCREASE IN FARM PRICE OF LOUISIANA SWEET POTATOES, 1931-44
(Nov. price = 100 per cent)

June prices averaged 41 per cent higher than November prices during the 14-year period. The increase from month to month was fairly uniform, with greatest changes from January to February and from April to May.

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[4] F. L. Thomsen and W. R. Fankhanel, *Factors Affecting Sweet Potato Prices in Missouri,* (Bul. No. 302; Mo. Agri. Exp. Sta., Columbia, Mo., April 1931).

[5] Martin A. Abrahamsen, *Consumer Preferences for Sweet Potatoes in Selected North Carolina Cities,* (Tech. Bul. No. 82; N. C. Agri. Exp. Sta., Raleigh, N. C., February 1947), pp. 16-17.

Seasonal Price Changes[6]

Seasonal price movements are important to growers in deciding whether to sell their sweet potatoes at digging time or to store part or all of their crop, and how long to store before selling. During the 14-year period 1931-44, prices reached a peak 21 per cent above the season average in August, when supplies were very scarce, then declined as the new crop came in. November was the month of heaviest sales and lowest prices. Prices rose 41 per cent from November to June, an average of about 6 per cent a month (Figure 8). The average change from month to month was fairly uniform, with increases from January to February and from April to May greater than in other months.

The average seasonal price pattern for years of small crops differed somewhat from the pattern in years of large crops (Figure 9). In the six years of smallest crops during the 1931-44 period, prices increased 23 per cent from November to February, compared with an average of 17 per cent during the same months in 8 years of larger-than-average crops. However, for the entire season, November to June, prices rose more in large crop years. Seasonal price changes are closely related

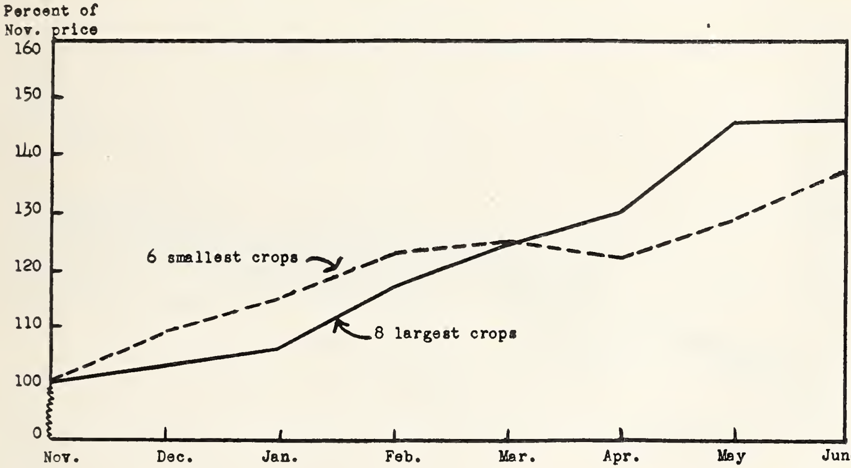

Fig. 9. — Seasonal Increase in Farm Price of Louisiana Sweet Potatoes During Years of Large and Small Crops, 1931-44

(Nov. price = 100 per cent)

Prices rose more from November to June in years of large crops than in years of small crops. Prices in small crop years rose more until March.

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[6] This analysis of seasonal price movements points out what has happened in past years, but does not fully cover the reasons for the differences in seasonal price patterns from year to year. A subsequent report will present a more complete analysis of these seasonal price changes. One limiting factor in analyzing seasonal prices and predicting future trends is the lack of data on storage holdings in Louisiana and other states. Such data are available for Irish potato holdings and are valuable in appraising future supply and price conditions for Irish potatoes.

to changes in the volume of sweet potatoes marketed. For example, in years of relatively large crops, the price increased only slightly from November to December because of the longer time necessary to move the large crop into market channels. Since smaller crops move faster, the price increase from November to December was greater in short crop years. After March, the size of the crop harvested the previous fall apparently is normally not reflected in the seasonal price pattern, because price increases from March to June in large crop years exceeded increases during years of small crops. One factor that may account for this difference is the higher proportion of the crop shipped late in the season in short-crop years. For example, in 6 years of relatively small crops 18 per cent of the season's shipments were made in April, May, and June, while in 8 years of relatively large crops only 13 per cent of the shipments were made in these months. These figures indicate that there was a tendency for those growers and shippers who store sweet potatoes to place about the same quantity in storage each year for late season sale, regardless of whether the crop was large or small.

Average seasonal price changes lose much of their meaning when individual years are compared with the average. For example, while

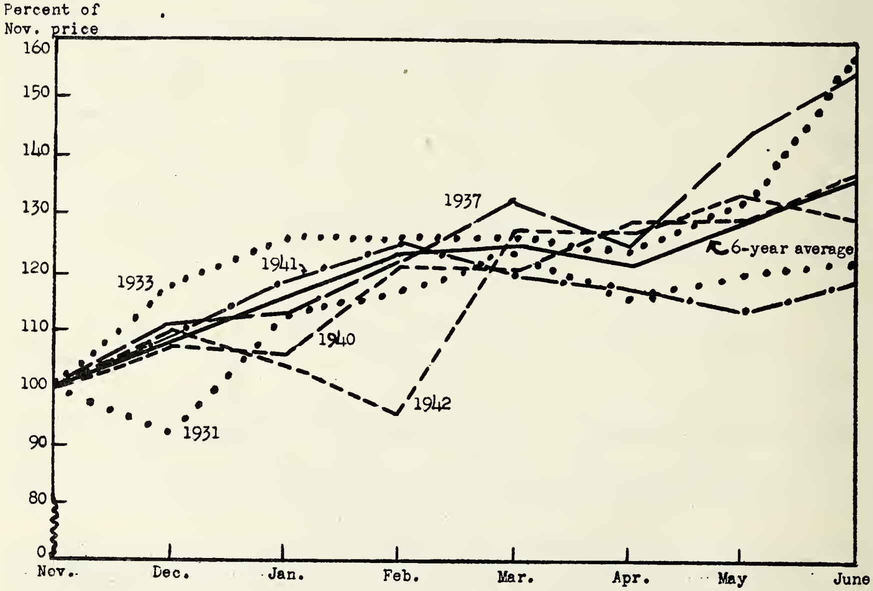

Fig. 10. — Seasonal Increase in Farm Price of Louisiana Sweet Potatoes During 6 Years of Small Crops

(Nov. price = 100 per cent)

The variations from year to year in the seasonal price pattern are so wide that the average price change can only be used as a rough indication of what may occur during any particular season.

the **average** increase from November to February in large crop years was 17 per cent, the increase in some years was as much as 39 per cent, and in others there was no increase at all. In years of small crops there was a tendency for individual years to conform more closely to the average seasonal price movement, but even in these years the variations were often large (Figure 10). Because of these wide differences from season to season, the average seasonal increase over a period of years is not a very reliable guide in predicting the price trend in any particular season.

It appears from the experience of those storing sweet potatoes that over a period of years seasonal price increases have been sufficiently large to more than cover storage costs.[7] Therefore, a grower would likely profit in the long run by storing his crop, but he could reasonably expect heavy losses in some years. Growers who do not have the financial resources to weather these unfavorable years should exercise caution in building expensive storage houses or storing a large proportion of their crop. Many growers hedge against possible heavy losses by selling a portion of their crop at digging time and storing the remainder in hopes of more favorable prices later in the season.

Summary, Conclusions, and Outlook

Long-time trends in sweet potato prices are important in making decisions where long-time investments, such as building a storage house, or major changes in the farm or business organization are concerned.

Since 1909 sweet potato prices in Louisiana have ranged from a high of $1.80 per bushel in 1924 to a low of 42 cents in 1932. The 38-year average is 93 cents. Periods of high prices were during World Wars I and II and the middle 1920's. The 1930's were years of below-average prices.

Sweet potato prices follow the general movements of all farm commodity prices because sweet potato prices, like the prices of other products, are affected by changes in the level of consumer purchasing power. If anticipated farm commodity price declines materialize, it is reasonable to expect lower sweet potato prices.

While the purchasing power of consumers (reflected in the price level of all farm commodities) will largely determine the general level of sweet potato prices, the long-time market position of Louisiana sweet potatoes, and consequently their price, can be improved by the continued efforts of the industry to increase consumer demand for Louisiana sweet potatoes, and to provide consumers with the type and quality of product which they desire and are willing to pay for. An increased consumer demand will permit the marketing of more sweet potatoes at favorable prices.

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[7] Storage costs include both direct and indirect costs, such as fixed charges on the storage house, interest, and losses due to spoilage and shrinkage.

The relationship between size of crop and farm price has been such in the past that large sweet potato crops have been of greater total value to the industry than small crops.

Year-to-year changes in sweet potato prices are largely the result of changes in the size of the crop, after allowance has been made for general farm commodity price level conditions. The usual relationship between production and price of pre-World War II years has not existed since 1942 because of abnormal economic conditions. It is not expected that 1942-46 conditions will prevail very much longer.

Other factors, such as the size of the Irish potato crop, apparently have little direct effect on year-to-year changes in sweet potato prices.

Seasonal Price Changes — The seasonal increase in sweet potato prices averaged 25 per cent from November to March, and 41 per cent from November to June, during the 14-year period 1931-44. Prices increased somewhat uniformly at an average rate of 6 per cent a month. However, the variations from year to year are so great that average increases over a period of years cannot be used as a reliable guide in predicting the movement for any particular season.

Over a period of years it appears that seasonal price increases more than offset storage costs, but this may not hold true in any given year. Consequently, storing sweet potatoes is somewhat of a speculation, and growers who are not financially able to stand occasional heavy losses should weigh with caution decisions regarding storage of their crop.

Sources of Data

Data on sweet potato prices and production and Irish potato production are from releases of the U. S. D. A. Crop Reporting Service and from "Agricultural Statistics." The index of prices of all farm commodities in the U. S. is from the "Monthly Labor Review," published by the U. S. Bureau of Labor Statistics.

TECHNOLOGY AND SCIENCE ROOM

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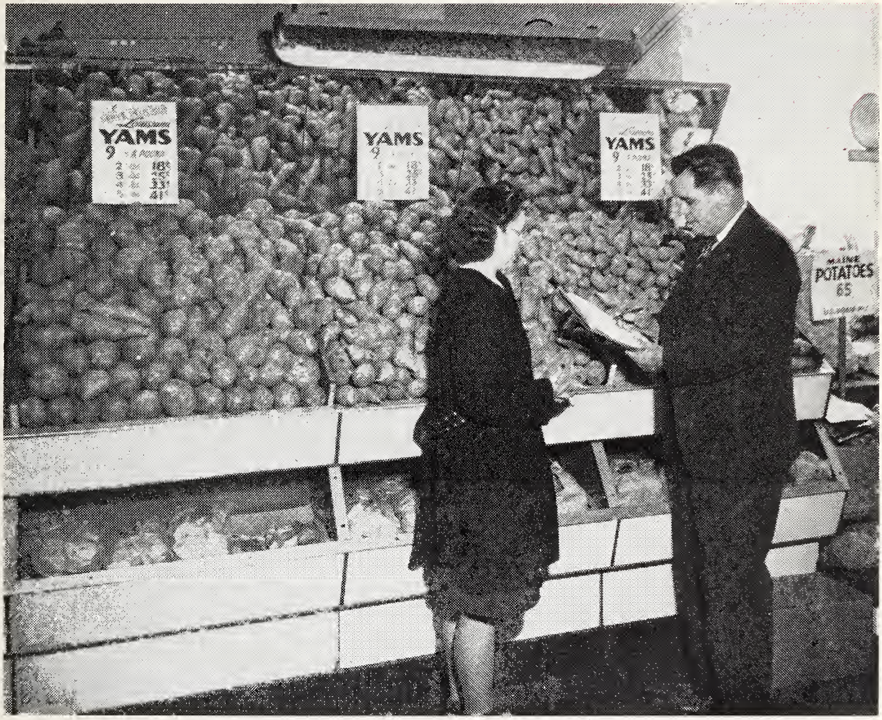
MARKETING LOUISIANA SWEET POTATOES IN PITTSBURGH

By

J. M. BAKER

Louisiana State Market Commission Cooperating

TECHNOLOGY AND SCIENCE



Interviewing Housewife Purchasing Louisiana Sweet Potatoes in a Retail Food Store in Pittsburgh

LOUISIANA STATE UNIVERSITY
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MAR 27 1961

TABLE OF CONTENTS

INTRODUCTION 3

DEALER ACCEPTANCE OF LOUISIANA SWEET POTATOES 4
- Grading 4
- Type of package 4
- Condition of product on arrival 5
- Consistency of quality shipments 5
- Other varieties 6
- Restaurant demand 6
- Canned sweet potatoes 6
- Merchandising methods 7

CONSUMER PREFERENCE AND RELATED DATA 7
- Grade Preference 7
- Size preference 8
- Principal buyer at retail store 11
- Size of family 11
- Size of purchase 11
- Frequency of serving sweet potatoes 12
- Methods of cooking sweet potatoes 12

SUMMARY AND RECOMMENDATIONS 12

ACKNOWLEDGMENTS 14

MARKETING LOUISIANA SWEET POTATOES IN PITTSBURGH

By J. M. BAKER*

Introduction

The sweet potato study conducted in Pittsburgh, Pennsylvania, during March, 1947, may be considered as somewhat of a supplement to previous studies in Louisiana and in Chicago.[1] Pittsburgh was selected for the survey because of its importance as an eastern market for Louisiana sweet potatoes. A total of 359 carlots, or about 5 per cent of the Louisiana shipments during 1946, were delivered to Pittsburgh and constituted 58 per cent of the total receipts at that market.

This study was undertaken for three main purposes: (1) to obtain information on dealer reaction to present quality and grades of Louisiana fresh and canned sweet potatoes; (2) to compare the findings in this study with the results of previous studies; and (3) to compile the data gathered into a comprehensive report for use by sweet potato producers and dealers.

The agencies cooperating in the study were the Louisiana State Market Commission and The Great Atlantic and Pacific Tea Company. The Commission provided the major portion of the personnel for the survey in Pittsburgh and supervised the grading of the sweet potatoes for the experiments, and the Company supplied the sweet potato exhibits and the retail store facilities.

The data collected on dealer reactions to Louisiana sweet potatoes were obtained through interviews with wholesalers and retailers at the terminal markets, managers of grocery companies, restaurant operators, and those in charge of different types of retail food stores. The consumer preference studies were conducted by using exhibits of sweet potatoes in four A. & P. food stores located to give a good cross section of the classification and purchasing power of Pittsburgh consumers. Some of the exhibits consisted of different grades and others of different sizes of sweet potatoes. Information on consumer preferences was obtained by observation, measurement of purchases, and interviews with consumers.

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* Associates in making the survey in Pittsburgh were J. O. Anders and Leonard Lagneaux of Louisiana State Market Commission. Among the studies especially helpful in the interpretation and appraisal of the data for this study were the ones by Professor Martin A. Abrahamsen, *Consumer Preferences for Sweet Potatoes,* N. C. Experiment Station Tech. Bul. 82, February, 1947; and by Professor W. T. Ferrier, *Marketing South Carolina Sweet Potatoes,* S. C. Experiment Station Bul. 352, November, 1944. The Tri-State Produce Company cooperated by providing an especially well-graded car of sweet potatoes for the study.

[1] J. M. Baker, *Consumer Preferences in Sweet Potatoes,* Louisiana Agricultural Experiment Station Bul. 409, January, 1947, which will be referred to in the present report as "previous studies."

Dealer Acceptance of Louisiana Sweet Potatoes

To gather information on the reaction of dealers to Louisiana fresh sweet potatoes, or "yams" as they are called in Pittsburgh, visits were made to 12 large distributors located at the terminal market and 14 wholesalers operating adjacent to the terminal market. For the data on canned sweet potatoes, six wholesale grocers and representatives of several chain store systems, independent retail units, and restaurants were contacted. The items of inquiry concerned the grading of sweet potatoes for market, type of package, condition on arrival, consistency and reliability of the quality of sweet potatoes received from Louisiana shippers, and other relevant information.

Grading

The first dealers to be contacted were the distributors at the terminal market where most of the sweet potatoes are unloaded. Almost without exception, the first reaction of these dealers was a plea for better quality and grading of this product. Many of the shipments were reported as meeting only the minimum of U. S. grade specifications. Laxities permitted during the war were still in evidence. The grades contained too large a portion of waste and off-sizes.

The wholesalers emphasized the urgent demand of retailers for better standardized products. Changes in merchandising practices in the stores call for continued improvement. The dealers were unanimous in the opinion that the extreme over- and undersized sweet potatoes should be excluded from shipment and the remainder packed in separate crates according to size. When properly divided, the more desirable size ranges should net a premium for use in stores handling the better grade products. The large size could be assigned to the retailers using lower priced merchandise. Since sweet potatoes are graded at the place of origin, all basic improvements in grading should begin at the farm or the shipping point.

Type of Package

Most of the dealers expressed preference for the James-type wirebound sweet potato crate used by practically all Louisiana shippers, provided it was clean, well-labeled and of good appearance. Attention was called to the fact that most wholesale distributing companies offer sweet potatoes to other wholesale dealers who in turn sell them to retailers. Under these circumstances, a good package greatly enhances the sales value of the product. The appearance of the crtate is less important, however, when the receiving firm moves the sweet potatoes directly to retail stores. Crating sweet potatoes according to size ranges would help to adjust prices to quality and make distribution to the different types of retail trade more equitable.

Condition of Product on Arrival

All of the wholesale dealers contacted reported Louisiana Porto Rico sweet potatoes, with few exceptions, arriving at Pittsburgh in good condition. Some attributed the occasional losses to sharp changes of temperature encountered in transit; others believed weather conditions at the shipping point the cause. The extent and causes of the injuries were not determined.

Consistency in Quality Shipments

The lack of consistency in repeating good quality shipments of Louisiana sweet potatoes to the city of Pittsburgh was next in importance to the plea for improvement in the quality of the grades. The unfavorable criticisms were directed at sweet potato shippers. Striking examples of inconsistency occurred in Pittsburgh while the study was in progress. One was that of a prominent Louisiana shipper who delivered to a chain store company a car of U. S. No. 1 sweet potatoes that were deficient in quality. The shipment contained too many misshapen and oversized sweet potatoes. This meant one of two things to the retailer: a disastrously low price for the product or a reduction in the amount of consumer purchases. And for this shipper, who, in a way, represented the producers of his community, there would be no repeat orders in the near future.

Another instance of inconsistency was that of a smaller Louisiana shipper who also delivered to the Pittsburgh terminal market a car of sweet potatoes below the standard of quality. Neither can this shipper expect additional orders from disappointed receivers. Who bears the brunt of such a deal? For the moment the receiving dealer, but in the long run, the shipper and the producer are the losers, especially the latter.

In contrast to the inconsistent dealers shipping Louisiana sweet potatoes to the Pittsburgh markets, there are those who are known for repeated delivery of quality products. One such shipper will be called Mr. "X" and his brand of sweet potatoes "Y." Mr. "X" not only adheres strictly to good quality but gives full measure of it. As a result "Y" sweet potatoes are well known and are in good demand by all types of Pittsburgh dealers handling sweet potatoes. One dealer at the terminal market has the exclusive agency for the "Y's" in that city. It is also known that this brand nets a premium of 25 to 50 cents a bushel over other brands of Louisiana sweet potatoes. The supply of "Y's" was exhausted before the close of the 1946-47 season. Mr. "X" makes a valuable contribution to both better demand and higher prices for the producer by making it possible for the consumer to constantly find good sweet potatoes in the retail stores. Shippers and producers have great responsibility to each other in marketing the sweet potato crop. As goes the quality of sweet potatoes offered the consuming public so goes the welfare of the industry.

Other Varieties

Although the study in Pittsburgh was designed to deal with Louisiana Porto Rico sweet potatoes, certain comparisons with other varieties, or the same variety from other states, could not be overlooked. Some of the dealers at the terminal market contended that the Louisiana Porto Rico sweet potato was superior to others in edible qualities. Be that as it may, it was quite evident that Louisiana "yams" possess relatively good store keeping qualities.

Restaurant Demand

Many restaurants were visited and the managers interviewed regarding their demand for sweet potatoes. The information obtained supported reports by the dealers that, by and large, restaurants use the low grades of sweet potatoes at low prices. Restaurant operators explained that customers at the table are not interested in the shape and size of the sweet potato, especially when sliced and candied, as it usually is. Sweet potatoes are not listed regularly on the restaurant menus. They are difficult to prepare when bought in the fresh form. Apparently the canned product has not yet appeared in a quality and price satisfactory for extensive restaurant use.

Canned Sweet Potatoes

Six wholesale grocers and many retail food stores of the different chains and independents were checked for information on canned sweet potatoes, with emphasis on the brands packed in Louisiana. The reports from all the stores were practically the same. The trade seemed partial to the No. 3 squat can packed with small, whole potatoes. There was difference in opinion on preference for the type of pack. Some favored the sirup and others the vacuum pack. All dealers referred to lack of consistency in quality. Some store managers reported customers as saying the canned sweet potatoes were hard and not well flavored; and others that they were too soft. Some said the canned product was too expensive as compared with the fresh sweet potatoes. It was the opinion of the enumerators that probably the sweet potatoes too small for the fresh market could be canned whole as a fancy pack for individual and restaurant use, and that a good quality of sliced sweet potatoes might be obtained from the larger sizes and offered at a reduced price. Much additional study is needed before specific conclusions can be drawn and definite recommendations made concerning these markets for canned Louisiana sweet potatoes.

Merchandising Methods

The change in merchandising practices and the rapidity with which these changes are being made in retail food stores are little less than revolutionary. Quality products prepackaged for the consumer in transparent bags of popular size evidently is the ultimate objective. In Pittsburgh a limited amount of prepackaging of sweet potatoes already is being done. Only well-graded and carefully standardized commodities can be merchandised successfully in this manner.

Consumer Preferences and Related Data

The study of consumer preferences in sweet potatoes included two types of exhibits, one of different grades and the other of different sizes. The related data pertained to such items as the principal buyers of sweet potatoes in the retail stores, size of family, size of individual and weekly purchases, frequency of serving, and methods of cooking sweet potatoes.

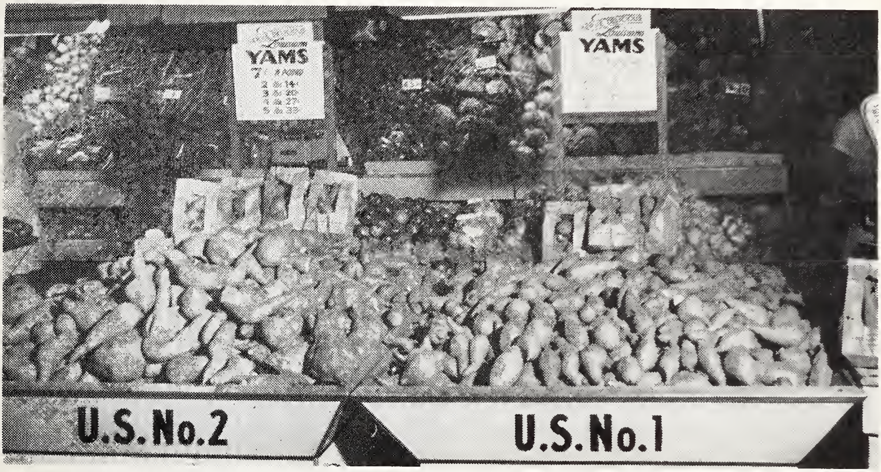

Figure 1.—Here U. S. No. 1 and U. S. No. 2 Louisiana sweet potatoes are shown during the last part of a three-period demand test in a Pittsburgh food store. The price of No. 1's remained constant and the price of No. 2's was lowered during the second and third periods to eight and seven cents a pound, respectively. Despite the reduced price of No. 2's, purchases favored No. 1's in the ratio of about four to one.

Grade Preference

For the grade tests in the stores, U. S. No. 1 and U. S. No. 2 sweet potatoes were exhibited side by side for a three-period duration. During the first period both grades were priced on the basis of 9 cents a pound. During the second and third periods the price of No. 1's remained constant while that of the No. 2's was lowered to 8 and 7 cents, respectively. No labels other than the price quotations appeared over the exhibits.

The grade tests revealed a somewhat constant demand for the U. S. No. 1 sweet potatoes over the No. 2's in the ratio of about four to one, irrespective of the declining price of the latter. In the way of explanation, the influence of the declining price of No. 2's on demand was fully counteracted by the relatively faster deterioration in appearance of this grade as compared with that of the No. 1.

Some may say that if only U. S. No. 2 sweet potatoes were put on display, they would be taken at the same price as U. S. No. 1's. So they would, but the quantity taken probably would be reduced to an unsatisfactorily low level. In the stores where the exhibits of the best quality were used, the demand for sweet potatoes was reported greatly stimulated. In some cases the sales were actually doubled.

The shipment of U. S. No. 2 sweet potatoes to distant markets, in the long run, is difficult to defend, except during periods of unusually strong demand and scarcity of the better grades. The fact that No. 2's possess the same food value as U. S. No. 1's is not enough. Eye appeal and size are the main factors affecting consumer choices and volume of purchases. Thus we find two forces competing for the consumer patronage: the better quality merchandise of the U. S. No. 1's and the lower price of the No. 2's. Since the average size of individual purchase is relatively small, as will be shown later, it is easy to understand why the demand is so strongly on the side of the better grade. But here attention should be called to the fact that some of the undesirable qualities of U. S. No. 2 sweet potatoes are also present to some extent in the U. S. No. 1's, that is, the extreme variation in sizes. Consumers like uniformity in products, and good merchandising practices require a high degree of it.

Size Preference

Aside from good appearance, size is the quality in sweet potatoes with which the housewife is most concerned. Size is closely associated with specific uses and ease of preparation. The wide variation in sizes causes the shopper inconvenience and confusion when she has to follow her neighbor to the sweet potato bin and pick from a deteriorated and motley lot. Probably no other farm product offered the retailer and the consuming public is more heterogeneous in so many ways. The problem of dividing the good quality sweet potatoes into size ranges best suited to merchandising uses and, at the same time, determining the most profitable method of disposing of the over- and undersized sweet potatoes is worthy of much careful study.

In the size preference study in Pittsburgh, U. S. No. 1 sweet potatoes were divided into size ranges designated as small, medium, and large. The small size included sweet potatoes measuring a minimum of one and three-fourths inches in diameter and weighing a maximum of 7 ounces; mediums weighed 8 to 12 ounces, and the large size 13 to 24 ounces. From these size groups two separate exhibits were constructed and placed in different stores. In one store the three sizes were placed side by side and quoted at the same price, as shown in Figure 2. In the other store the small and medium sizes were combined and exhibited beside the large size, as presented in Figure 3. The duration of the second experiment was divided into three periods, with the price of the small and medium sizes remaining at the base of 9 cents a pound, while the large size was quoted, for the three periods, at 9, 7, and 5 cents a pound, respectively.

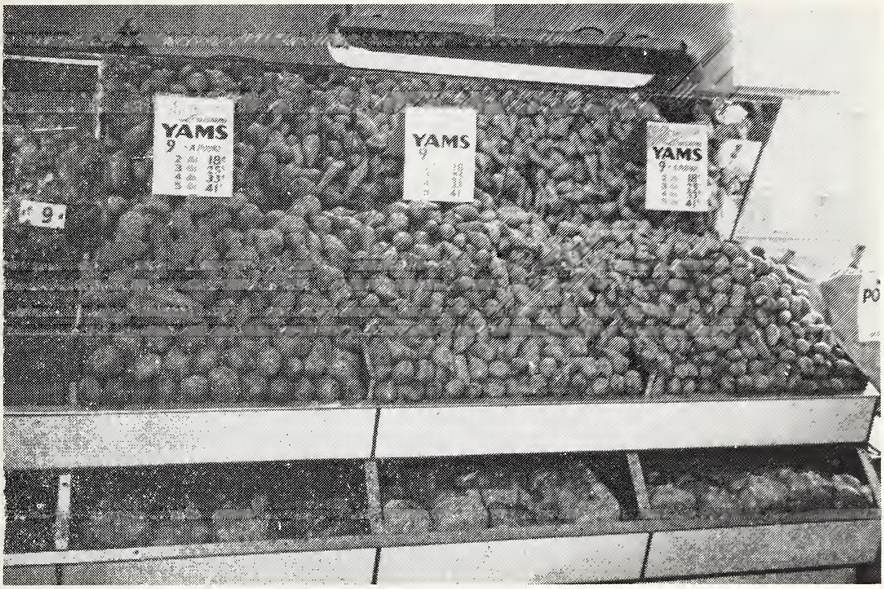

Figure 2.—This display of U. S. No. 1 Louisiana sweet potatoes graded large, medium and small was used in the study in a Pittsburgh food store and resulted in a doubling of normal sales. Customers showed a strong preference for the medium-sized potatoes.

At the store where the three sizes were exhibited separately, the purchases of 273 customers comprised 31 per cent small size, 50 per cent medium size and 19 per cent large size. These figures correspond closely to the results of the study in Louisiana and in Chicago.

At the store where the small and medium size sweet potatoes were combined against the large size, the test was designed to determine the effect of price changes on the demand for the large size. When both lots were quoted on the basis of nine cents a pound, 94 per cent of the purchases consisted of small and medium sizes and 6 per cent of the large size. As the price relation changed to 9 and 7 cents, respectively, the consumer preference was reversed to 61 per cent in favor of the large size

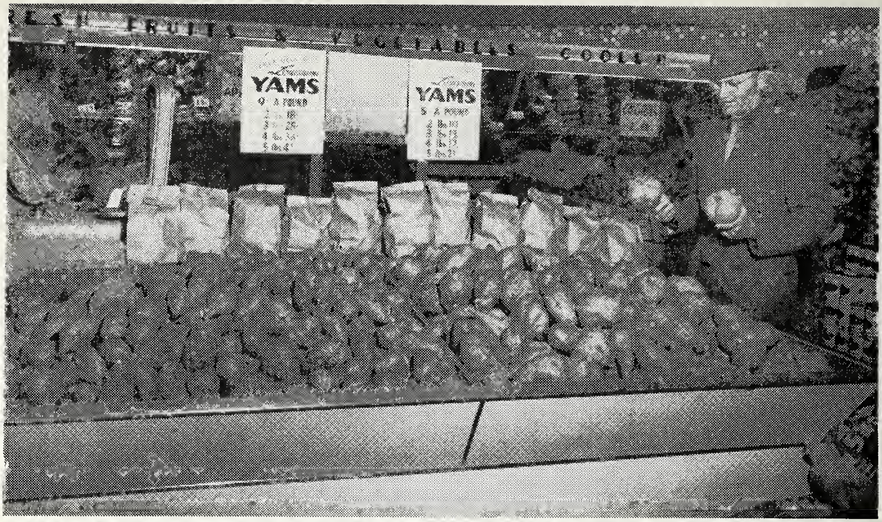

FIGURE 3.—The Louisiana "big" sweet potato problem being attacked by one of the research leaders in a Pittsburgh food store. Even though all the sizes were within the U.S. No. 1 grade, there was a much lower demand for the larger sizes, and to move the large potatoes in satisfactory volume the price had to be lowered below that of the other sizes.

and 39 per cent in favor of the small and medium sizes. When the price of the large size was lowered to 5 cents, the preference shifted back to the smalls and mediums in the ratio of 52 per cent to 48 per cent. This last reversal was due to the fact that the more desirable potatoes in the large group had been picked out and only the excessively large sizes remained in the large-size lot.

Both shippers and retailers who struggle with the disposition of the large sweet potatoes may find this observation of much importance. The large sweet potatoes may contain as much food value as the small and medium sizes, but the fact that they are much less in demand places them, from the standpoint of merchandising, in a lower price bracket. Therefore, to maintain equal quantity of sales among the different size groups, differentials in price must be adjusted to the differentials in demand.

Although the division of sweet potatoes into size groups leads to better methods of fitting the supply to market demand, the experiment leaves some problems yet unsolved. For example, there is a minimum price at which any grade of Louisiana sweet potatoes may be handled at distant markets and, at the same time, a profit secured for the producers. No doubt there is an appreciable portion of the present U. S. No. 1 grade which comprises excessively large sweet potatoes that could not command the minimum price and move in satisfactory quantity. Also, a high percentage of the small sizes weighing under six ounces are not in demand at a profitable price. Further study is necessary, therefore, to determine the proper divisions to make in the size ranges for the fresh market, and to determine definitely the sizes that should be assigned to other uses.

Principal Buyer at Retail Store

Of the 382 customers purchasing sweet potatoes at retail food stores in Pittsburgh, 75 per cent were housewives, 21 per cent husbands and 4 per cent children or friends of the family. The housewife, therefore, is the principal consumer whose demands must be considered by sweet potato producers and dealers.

Size of Family

The results of this study coincide closely with the findings in the previous studies. Of the 320 families represented by customers purchasing sweet potatoes, 30 per cent averaged fewer than three persons in size, including parents, and 73 per cent fewer than five. Only 15 per cent consisted of six or more. The average size of family was 3.7 persons. These data indicate that adults and not children are the principal consumers of Louisiana sweet potatoes.

Size of Purchase

The percentages of the different sizes of individual and weekly purchases of sweet potatoes are shown in Table 1. For the U. S. No. 1 and U. S. No. 2 grades the average size of single, or individual, purchases was 3.1 pounds, and the average for the week was 4.5 pounds. In the tests with the small, medium and large sizes, the individual purchases averaged, respectively, 2.6, 3.3, and 4.2 pounds. Most of the larger individual and weekly purchases appeared to be associated with food habits rather than ability to pay. The prices were believed too high to induce larger weekly purchases in the lower purchasing power group of consumers. However, a more extensize study conducted by Professor Abrahamsen of North Carolina Agricultural Experiment Station in North Carolina on the relation of income and sweet potato purchases reveals that the weekly purchases in the lowest income class, that is, the class with family income below $100 a month, were 45 per cent higher than

TABLE 1. SIZE OF INDIVIDUAL AND WEEKLY SWEET POTATO PURCHASES BY 368 CUSTOMERS AT RETAIL FOOD STORES IN PITTSBURGH, MARCH, 1947

Purchases*	Per cent of each size of purchase in pounds										
	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten-up	Total
Individual ..	16.0	26.4	37.2	10.3	5.2	2.4	.2	.0	.0	2.3	100.0
Weekly	10.7	13.7	32.1	14.9	8.5	9.0	2.6	5.1	1.3	11.1	100.0

* Average size of individual purchases: for U. S. Nos. 1 and 2, was 3.1 pounds; and for small, medium and large sizes, 2.6, 3.3, and 4.2 pounds, respectively. Average amount of weekly purchases was 4.5 pounds.

in the highest income class considered where the family income was over $200 a month.[2]

Frequency of Serving Sweet Potatoes

The frequency with which the families are served sweet potatoes may depend principally on how well the family likes them. Seventy-two per cent of the customers interviewed reported serving their families sweet potatoes one to two days a week. Eighty-eight per cent served not more than three days a week. The average per week was 2.1 days.

Methods of Cooking Sweet Potatoes

The different qualities in sweet potatoes, especially size, are closely associated with the methods of preparation. Of the 531 times that different methods of cooking sweet potatoes were mentioned by the sweet potato customers, oven-baking was given 53.3 per cent of the times, candying 23.7 per cent, cooking with meat 10.0 per cent, frying 8.5 per cent, and making the sweet potatoes into such dishes as pies and puddings, 4.5 per cent. On the whole, the small and medium sizes were baked or cooked with meat and the larger ones used for the other purposes. These and other data indicate very little difference in the manner of serving sweet potatoes in different parts of the country.

Summary and Recommendations

To obtain the reaction of Pittsburgh dealers to Louisiana sweet potatoes, 26 distributors and wholesalers were interviewed. This survey revealed (1) that sweet potatoes intended for the fresh markets should be more carefully graded. Present receipts, on the average, contain too high a percentage of waste and off-sizes; (2) that with improvements in merchandising practices by retailers, better standardized products are required with emphasis principally on good appearance and a high degree of uniformity in shape and size; (3) that probably sweet potatoes intended for the retail trade should be graded and packed for shipment according to size, thereby making distribution to the different types of stores more equitable; and (4) that better standardization of the product will greatly stimulate the demand.

As to the type of sweet potato package, wholesale dealers offered no adverse criticism of the James crate used by Louisiana shippers provided it was clean, well-labeled and of good, general appearance.

On the whole, sweet potatoes from Louisiana were reported arriving at Pittsburgh in good condition.

Pittsburgh dealers complained of the lack of consistency in the quality of Louisiana sweet potatoes. Few shippers could be relied upon to deliver good quality repeatedly. Brands that are constant in quality net repeat orders and a premium in price.

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[2] Martin A. Abrahamsen, *Consumer Preferences for Sweet Potatoes,* N. C. Experiment Station Tech. Bul. 82, February, 1947.

Compared with other varieties of sweet potatoes at the Pittsburgh markets, the Louisiana product appeared to be in a favorable position, especially in relation to edible and keeping qualities.

A study of the restaurant demand for sweet potatoes revealed that, because the product is usually sliced and candied for table use, the supply was selected from the lower grades.

Canned sweet potatoes, which included Louisiana brands, were reported as lacking quality in some cases and uniformity of quality in others. The small can of whole sweet potatoes, both vacuum and sirup pack, was reported most popular among housewives. It is believed there is a need for lower priced canned sweet potatoes that might be obtained from off-sized and poorly shaped sweet potatoes.

The changes in merchandising methods in the retail food stores call for greatly needed changes and improvement in grading and standardizing sweet potatoes for the fresh produce markets. Along with many other products, sweet potatoes are being prepackaged for the store customers. Prepackaging requires a definite standard and quality of merchandise.

The tests for consumer preferences in the grade and size of sweet potatoes in the Pittsburgh stores indicated (1) that with U. S. No. 1's quoted at nine cents a pound and U. S. No. 2's at seven cents, purchases favored the former four to one; (2) that where the different sizes of U. S. No. 1's were quoted at the same price consumers chose 31 per cent small sizes, 50 per cent mediums, and 19 per cent large sizes; and (3) that when the small and medium sizes were combined and tested against the large sizes, it was necessary to reduce the price of the large sizes about two cents a pound in order to get equal volume of purchases. This indicated that the large size sweet potatoes are less in demand and come within a lower price bracket.

Other information obtained from consumers at the retail food stores indicated that (1) 75 per cent of the buyers of sweet potatoes were housewives; (2) the average size of families using sweet potatoes, including parents, was 3.7 persons; (3) the average size of single purchases was 3.1 pounds and of weekly purchases 4.5 pounds; (4) sweet potatoes were served to the families an average of 2.1 days a week; and (5) that sweet potatoes were oven-baked over 53 per cent of the times, candied 24 per cent, and cooked with meat, fried or made into casserole dishes the balance of the times.

The studies of consumer preferences for the different grades and sizes of sweet potatoes have led to the conclusion that certain revisions should be made in the pattern of grading sweet potatoes for the fresh produce market; that sweet potatoes possessing the other favorable marketing qualities should be graded according to size and placed into definite size groups.

There appears to be prominent inconsistency in the present grade specifications for sweet potatoes. For example, the U. S. No. 1 grade includes sweet potatoes which would fall into different price brackets in the retail food stores. It has been indicated by tests and extensive observation that the small and medium sizes command a higher price than the large size, and that there are those of the extremely small and large sizes which the trade will not take at a price profitable to the producer.

Acknowledgements

The author is indebted to many individuals, in addition to his professional associates, for assistance and cooperation in this study: to Merton L. Corey and Claybourne Ross of Carl Byoir and Associates, Inc., an affiliate of The A. & P. Tea Company, for help in planning and making arrangements for the work in Pittsburgh; to W. W. Roberts, Executive Secretary, Louisiana State Market Commission, and his associates, J. O. Anders, Leonard Lagneaux and H. B. Swindler, for preparing the sweet potatoes for the study and actually helping with the enumeration; to Harry W. Johnson, President of Tri-State Produce Company, and E. S. Richardson of Louisiana State Department of Commerce and Industry, for arranging for the sweet potato supply; to J. J. Gardner, Head of U. S. Inspection Service in Pittsburgh, for assistance and many professional courtesies; to P. T. Ecton of Warriner Products Company, for cooperation and valuable counsel; and last but certainly not least, to L. C. Baum, Jr., Vice-President, Atlantic Commission Company, and his associates, W. H. Bayliss in Pittsburgh and W. Simmons of Opelousas, Louisiana; and the personnel of The A. & P. Tea Company in Pittsburgh, including H. F. Peterson, Sales Manager, H. W. Klingensmith, Produce Personnel Trainer, A. P. Catterall, Advertising Manager, and Joseph Ludwig, Lewis Sowa, M. M. Moschiwsky and J. T. Schwartz, Store Managers, and many others of the staff who extended wholehearted cooperation and helped to make the study in Pittsburgh possible. Pittsburgh dealers also were thoroughly cooperative and cheerfully provided needed information.

TECHNOLOGY AND SCIENCE ROOM

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UTILIZING SWEET POTATOES AS FEED FOR DAIRY CATTLE

By

D. M. SEATH, L. L. RUSOFF,
G. D. MILLER AND CECIL BRANTON

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
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LOUISIANA STATE UNIVERSITY

AND

AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

Summary

1. Sweet potatoes are a good carbohydrate feed for dairy animals when used freshly chopped or dehydrated. Sweet potato vines are also of value as a feed.

2. Sweet potato vines when used as a supplemental pasture for milking cows have shown increases in milk production averaging 19 per cent over that from cows on permanent pasture.

3. Freshly chopped sweet potatoes have been found to be 2.5 times as valuable as silage in the dairy ration.

4. In feeding experiments dehydrated sweet potatoes made from whole tubers were palatable, while a product of poor quality made from culled, bruised, and sectioned potatoes was slightly unpalatable.

5. For milk production, dehydrated sweet potatoes contained 88 per cent of the value of yellow corn meal, and they were approximately 17 per cent more valuable than ground ear corn, including cob and shuck.

6. Digestion trials showed that the good quality dehydrated sweet potatoes contained from 76 to 81 per cent total digestible nutrients, while a poor quality product contained 71 per cent T.D.N. on the dry basis.

7. The high carotene content of Porto Rico varieties of sweet potatoes increases the vitamin A value of the butterfat.

UTILIZING SWEET POTATOES AS FEED FOR DAIRY CATTLE

By

D. M. SEATH, L. L. RUSOFF, G. D. MILLER AND CECIL BRANTON*

There is much demand for information on the feeding value of sweet potatoes. Sweet potato tubers have been chopped and fed in the fresh stage, and the vines have been used as a supplemental grazing crop. Recently, dehydrated sweet potatoes, a product relatively new to most farmers, have appeared on the market.

Dairymen are especially interested in this dehydrated feed, which made its first appearance about 10 years ago but did not attain large-scale production until during World War II, when the demand for it as human food, especially for shipment abroad, caused a phenomenal expansion in the industry. At present there are 67 dehydrating plants in Louisiana, of which 50 are used exclusively for dehydrating sweet potatoes. Present evidence tends to indicate that a larger percentage of this dehydrated product will be utilized as livestock feed and that dairy herds will be fed a major portion of it. This will be especially true if the cost of the product is kept in line with its relative feeding value. Under such conditions this new product will do much toward helping southern communities produce more of their own concentrate feeds, thus reducing the heavy expense of importing these feeds.

I. Grazing Sweet Potato Vines

Not only is the sweet potato tuber an excellent cow feed, but the vine is likewise nutritious and is relished by dairy cows. Reports[1] made on experiments conducted for 7 years at the North Louisiana Experiment Station show the value of sweet potato vines as pasture (Table 1).

Stimulation to milk production was shown in all of the experimental trials by cows grazing sweet potato vines. This was especially true when cows had previously been grazing permanent pasture which was usually low in palatability and in production in the late summer and fall months. Over a 7-year period this average increase in milk yields for Jersey cows was 19 per cent. Likewise, the milk production averaged 10 per cent higher than when cows were grazing soybeans, thus giving evidence that sweet potato vines would rank near the top among supplemental crops available for stimulating higher milk yields during late summer and early fall months.

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* Dairy Husbandman, Associate Dairy Nutritionist, Assistant in Dairying, and Assistant Dairyman, respectively. Acknowledgement is made of the experimental work prior to 1939, particularly on utilizing the fresh sweet potatoes and vines, conducted by R. H. Lush, formerly dairy husbandman of the Station.

[1] Data taken from annual reports submitted to the Director by R. H. Lush, formerly dairy husbandman of the Louisiana Agricultural Experiment Station.

TABLE 1. SUMMARY OF SWEET POTATO VINES GRAZING EXPERIMENTS AT NORTH LOUISIANA EXPERIMENT STATION

Year of test	Acres sweet potatoes	Days grazed	Cow days per acre	Pounds milk per acre
1933	1.5	66	123	No record
1934	2.0	27	54	" "
1935	2.0	25	50	" "
1936	2.5	13	21*	" "
1937	2.0	25	85	1816
1938	2.5	48	87	2167
1939	2.5	30	36	851
Average	2.14	33.4	65.1	1611

*In 1936, 36 per cent of the vines were not consumed.

The period that the vines were grazed was relatively short, varying from 13 to 66 days and averaging 33.4 days. The cow days per acre were about double the number of grazing days and varied from 21 to 123 and averaged 65.1. This shows that the average carrying capacity was approximately 2 cows per acre for a period of 33 days.

Grazing of the sweet potato vines was started at varying times ranging from July 12 to September 19. Factors affecting the time when first grazed included time when potatoes were set out and the prevailing weather, particularly the amount and distribution of rainfall.

When sweet potato vines are grazed several times during the growing season instead of just before the tubers are harvested, there is an increase in the amount of grazing secured, but a reduction in the tubers harvested. This decrease in the yield of tubers averaged 21 per cent. There was a direct correlation between the time of grazing and the loss in yield of tubers. The earlier the vines were grazed, the greater the loss of potatoes harvested.

II. Feeding Freshly Chopped Potatoes

When sweet potatoes are chopped, as with a corn knife, and fed fresh they are relished by dairy cattle and are highly nutritious. When properly stored they can be thus fed over a period of 2 to 4 months and make an important contribution to the fall and early-winter ration at a time when milk-stimulating feeds are badly needed. In 4 feeding tests conducted at the North Louisiana Experiment Station[1] it was found that 100 pounds of chopped sweet potatoes equalled 250 pounds of sorgo or corn and soybean silage. Thus it would appear that dairymen in need of silage or without sufficient silage could feed 10 to 15 pounds of chopped sweet potatoes daily per cow and could expect results comparable to the feeding of from 25 to 38 pounds of silage per cow daily.

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[1] Data taken from annual reports submitted to the Director by R. H. Lush, formerly dairy husbandman of the Louisiana Agricultural Experiment Station.

III. Dehydrated Sweet Potatoes as Dairy Feed

Comparative Chemical Analyses

One of the first questions asked about the dehydrated sweet potato product is, how does its chemical analysis compare with that of the fresh sweet potato? In general, the answer most nearly correct is that the dehydrated product is the same as the fresh sweet potato after most of the water is removed. It takes about 3 pounds of the fresh potato to produce 1 pound of the dehydrated feed. The commercially dried product contains around 7 to 10 per cent water as compared to around 70 per cent for fresh sweet potatoes.

Shown in Table 2 are the chemical analyses* of the various dehydrated sweet potato products tested experimentally by the Dairy Research Department of the Louisiana Agricultural Experiment Station. Also are shown the average analyses of corn meal, ground corn with cob and shuck, and dried beet pulp. These are all similar in chemical analyses to dried sweet potatoes and are listed for comparative reasons only. Inspection of the percentages of these various constituents shows that the crude protein content of the dried sweet potatoes averages around one-

TABLE 2. Chemical Analyses of Dehydrated Sweet Potatoes Tested Experimentally Along with Other Feeds Similar in Feeding Value*

Kind of Feed	Year fed	Percentages of the various constituents					
		Water	Crude protein	Fat	Crude fiber	Nitrogen-free extract	Ash
Dehydrated sweet potatoes (starch variety)............	1944	8.73	2.50	0.64	2.93	82.36	2.84
Sundried sweet potatoes (starch variety)..................	1944	16.80	4.13	0.85	3.48	70.56	4.18
Dehydrated sweet potatoes (Porto Rico)..............	1945	6.80	5.00	0.85	3.90	79.98	3.47
Dehydrated sweet potatoes (Porto Rico)..............	1946	7.04	4.69	1.24	1.55	82.39	3.09
Dehydrated sweet potatoes, poor quality, (Porto Rico).	1946	9.60	4.56	0.50	4.32	77.74	3.23
Corn meal (No. 1), listed for comparison................	†	12.8	9.6	3.9	2.3	70.0	1.4
Corn, with cob and shuck, listed for comparison..............	†	9.0	8.7	3.2	10.4	66.8	1.9
Dried beet pulp, listed for comparison................	†	18.0	9.0	0.8	18.8	59.9	3.5

*Frances Bonner and C. C. Moreland of the Feed and Fertilizer Laboratory aided with some of the analyses.

†Analyses of comparative feeds taken from F. B. Morrison's *Feeds and Feeding*. 12th Ed. 1945. The Morrison Publishing Co., Ithaca, New York.

half that found in the corn, corn with cob and shuck, and dried beet pulp. The fat content is very low compared to corn and about the same as for beet pulp. In crude fiber content, there is very little difference between the dried potato products and corn meal. On the other hand, the content of nitrogen-free extract (soluble carbohydrate) is slightly higher in dried sweet potatoes than in any of the comparative feeds listed.

Variations shown in the percentages of the various constituents in the dried sweet potato products is a point of special interest. This tends to suggest that factors such as the variety of potatoes, the fertility of the land on which the potatoes are grown, and the dehydrating process itself may all have important effects on the actual chemical analysis of the final product. In this connection, it should be pointed out that the Porto Rico varieties produce a dehydrated feed that is relatively high in its content of carotene, the yellow pigment converted by animals into vitamin A. At the other extreme is the white starch variety of sweet potato such as L 4-5, which produces a dehydrated feed containing little, if any, carotene.

Feeding Experiments

In the first feeding experiment, conducted in 1944, dehydrated sweet potatoes were compared with ground yellow corn meal. Air-dried sweet potatoes that were first chopped by a homemade shredder and spread over a concrete surface for drying were used for the first two periods of the trial. A shortage of this material necessitated using a commercially dried product for the last period of the experiment. Both products resulted from drying a high-starch sweet potato variety, such as the L4-5, developed by the Horticulture Research Department of the Louisiana Agricultural Experiment Station. During the war the portion of the acreage devoted to producing this starch variety decreased in favor of the sweeter Porto Rico varieties.

Simple concentrate mixtures were fed in this trial, for it has been shown that cows do not require a complex grain mixture.[2] The mixtures consisted of 3 parts by weight of ground dehydrated sweet potatoes, or 3 parts by weight of ground yellow corn; 1 part of 41 per cent cottonseed meal; and 1 per cent each of salt, special process steamed bone meal, and powdered oyster shell. These mixtures were fed to 16 Holstein and 4 Jersey cows at the rate of approximately 9 pounds for each pound of butterfat produced. In addition, each cow received approximately 30 pounds of corn silage and 17 pounds of either lespedeza or Alyce clover hay daily. For each period one-half of the cows received the sweet potato concentrate mixture and one-half received the corn concentrate mixture.

About one-half of the cows relished this starch variety sweet potato meal from the start. The other half required from one to four days to become accustomed to the change. After the change was completed, the cows ate sweet potato meal as readily as they ate corn meal. Changes in body weights of the experimental cows gave no definite evidences that the two feeds differed significantly.

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[2] Louisiana Agricultural Experiment Station Annual Report, 1942-43, pp. 63-64.

While the cows were fed the yellow corn meal mixture the daily milk yields averaged 27.4 pounds, as compared to 26.3 pounds while being fed the dehydrated sweet potato mixture. The difference of 1.1 pounds per cow daily represented 4.05 per cent. The butterfat yields also favored the corn meal mixture by an average of 4.55 per cent. Based on the replacement values of the two feeds in the dairy ration, this first trial indicated that dehydrated sweet potato meal was equal to approximately 88 per cent of corn.

A second feeding experiment was conducted in 1945. The commercially dried potatoes used in this experiment were the highly colored and sweeter Porto Rico variety. The product proved to be very palatable, and was readily eaten by all cows. The concentrate ration consisted of 3 parts, by weight, of dehydrated sweet potato meal and 1 part of cottonseed meal. To this was added 1 per cent each of salt, special process steamed bone meal, and oyster shell flour. The second concentrate ration was the same except that ground ear corn (including cob and shuck) replaced the sweet potato. Adjustment was made in the corn concentrate ration so that 20 per cent more corn, but the same amount of cottonseed meal, was fed as in the sweet potato ration. This was done in an effort to help compensate for the extra bulk in the form of cob and shuck found in the corn mixture.

Milk yields, based on a four per cent equivalent basis, were almost identical on the two rations, i.e., 24.9 pounds per cow daily on sweet potatoes, and 25.0 pounds on the corn mixture. Body weight changes of the 16 Holsteins and 4 Jerseys used in the experiment were almost identical. In general, they liked the sweet potato ration better than the more bulky corn ration which included the cob and shuck. This was a partial reflection of the chemical analyses of the two rations, which showed slightly less than one-half the fiber in the sweet potato mixtures as in the corn mixture. On the other hand, the corn ration contained slightly more protein.

This experiment indicated that 1.0 pound of sweet potato meal was approximately equal to 1.2 pounds of ground ear corn (including cob and shuck) when fed in combination with cottonseed meal to cows receiving legume hay and corn-soybean silage.

The high carotene content of the sweet potatoes increased the vitamin A content of the butterfat approximately 20 per cent over that of the butterfat produced from cows fed ground corn. The values were 43 international units per gram as compared to 35 international units per gram.*

The third experiment conducted at the Louisiana station, in 1946, demonstrated the importance of having a good quality product. One batch of dehydrated sweet potatoes fed was that produced as a by-product from a commercial plant producing a food for human consumption. This poor quality dehydrated product resulted from utilizing cull potatoes, peelings, bruised sections of potatoes, etc., and was darker in color than the previous meals. However, this product appeared to be a desirable feed. Reactions of livestock told a different story. Many animals refused to eat normal quantities of the feed and would entirely go off feed from time to time. The same animals when fed dehydrated sweet potatoes made from whole tubers ate normal amounts each day.

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* Miss Harvye Lewis of the Department of Agricultural Chemistry and Biochemistry determined the vitamin A assays of the butterfat.

IV. Digestion Trials*

Four dairy steers weighing from 400 to 500 pounds each were used as experimental animals. The procedure used included the use of at least a 10-day preliminary period and a 10-day collection period. The feces were collected in a canvas collection bag. A 1/50 aliquot was taken from each day's fecal output for each steer and stored in a refrigerator at O° C. until completion of the collection period. Nitrogen determinations were made on aliquots of the fresh excreta, while dried excretum samples were used for the other analyses.

The basal feeds used were common lespedeza hay, Alyce clover hay, or Kobe lespedeza hay and cottonseed meal. Digestion coefficients were determined for these feeds prior to each sweet potato digestion trial.

Trial I was made on a 1945 commercial dehydrated sweet potato meal (Porto Rico variety) using common lespedeza hay as a basal feed. Four to five pounds of dehydrated sweet potato meal were fed to each steer and replaced an equivalent amount of hay on the digestible protein and total digestible nutrients basis in the basal ration. The amount of hay was adjusted so that the animals maintained their weights during the preliminary period, after which the digestion trial was begun. Trial II made use of Alyce clover hay and a 1946 commercial dehydrated sweet potato meal; Trial III, Alyce clover hay and a 1946 commercial dehydrated poor quality sweet potato meal made from cull and sectioned potatoes; Trial IV, Kobe lespedeza hay and cottonseed meal and a 1947 commercial dehydrated sweet potato meal.

The compositions, average apparent coefficients of digestibility, and total digestible nutrients of the dehydrated sweet potatoes on the dry basis for the various trials are presented in Table 3.

The apparent variations and non-digestibility of the protein, fat and fiber of the dehydrated sweet potatoes as seen in Table 3 might be explained by the small proportion of the total intake of these constituents in the ration. The apparent non-digestibility of the crude protein may be due to several factors, namely, (a) heating of the protein during the drying process, which could tend to make it less digestible, (b) the presence of non-protein nitrogen compounds that are not digestible, or (c) an apparent depression of digestibility.

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* L. L. Rusoff, D. M. Seath, and G. D. Miller. "Dehydrated Sweet Potatoes—Their Feeding Value and Digestibility." Jour. Dy. Sci. 10:1947 (in press).

TABLE 3. The Composition, Average Apparent Digestion Coefficients, and Total Digestible Nutrients of Commercially Dehydrated Sweet Potatoes (Dry Basis)

Trial	Dehydrated sweet potatoes	Dry matter	Crude protein	Crude fat	Crude fiber	Nitrogen-free extract
		%	%	%	%	%
I	1945	92.70	5.39	0.91	4.21	86.28
II	1946	92.96	5.04	1.47	1.67	88.63
III	1946 (poor quality)	90.40	5.04	0.55	4.78	85.99
IV	1947	85.35	4.17	1.15	4.46	84.88
Average Apparent Digestion Coefficients						Total digestible nutrients
					N.F.E.	
I	1945		16.71		94.46	81.06
II	1946		−24.74	49.07	84.53	76.38
III	1946 (poor quality)*		−52.36	.....	83.47	71.78
IV	1947		−40.29	94.17	88.23	79.31

*Analyses based on three steers only; product made from cull and sectioned potatoes was slightly unpalatable, one of the steers refusing to eat his quota.

In this study the coefficients of digestibility for the nitrogen-free extract were consistent. As this constituent made up over 84 per cent of the dry matter in the dehydrated sweet potato, the apparent lack of digestibility of the other constituents had but small effect on the total digestible nutrient content. The low content of protein precludes this product from being an important source of this nutrient. The total digestible nutrient values for commercial dehydrated sweet potatoes ranged from 76 to 81 per cent on the dry basis; the poor quality commercial dehydrated sweet potatoes made from cull potatoes, peelings, and bruised sections of potatoes contained 71 per cent total digestible nutrients.

V. Suggested Concentrate Mixtures Using Dehydrated Sweet Potatoes

Dairymen should keep in mind that simple concentrate mixtures when fed in combination with good pasture or other high quality roughage give results comparable to those secured by feeding complex concentrate mixtures.[2] The explanation, in view of present scientific knowledge, is that certain microorganisms such as bacteria live and multiply in the paunch of the cow and change some simple food nutrients into more complex ones. For example, some of these microorganisms can convert simple proteins into more complex protein compounds. It is also known that certain vitamins (B family vitamins) are synthesized in the paunch of the cow. Therefore, simple concentrate mixtures when they are digested supply the necessary bodily requirements of dairy cattle. Simple-stomach animals such as the chicken and the hog, however, must have a complex ration because of their inability to synthesize sufficient quantities of these nutrients.

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[2] Louisiana Agricultural Experiment Station Annual Report, 1942-43, pp. 63-64.

Experiments, as herein reported, made use of simple concentrate mixtures such as dehydrated sweet potato meal, cottonseed meal, and minerals. Such mixtures are listed below but, in addition, others are given in order to suggest many variations that can be used, depending on the amounts of various feed constituents available. It should be kept in mind that these other mixtures have not been tested experimentally at this station, but are based on the comparative value of dehydrated sweet potatoes as a replacement for corn and other similar feeds in the concentrate mixture. It should also be stated that it is necessary to use a dehydrated sweet potato product that has a naturally high palatability for best results.

I. To be fed with green succulent pasture or when cows are being fed liberal amounts of good legume hay.

1. (15% crude protein)
500 lbs. sweet potato meal
200 lbs. cottonseed meal
10 lbs. salt
7 lbs. bone meal

2. (15% crude protein)
400 lbs. sweet potato meal
200 lbs. bran
200 lbs. cottonseed meal
12 lbs. salt
8 lbs. bone meal

3. (14% crude protein)
200 lbs. sweet potato meal
200 lbs. ground corn or hominy
100 lbs. rice bran
100 lbs. cottonseed meal
9 lbs. salt
6 lbs. bone meal

4. (14% crude protein)
300 lbs. sweet potato meal
100 lbs. cottonseed meal
200 lbs. ground oats or wheat bran
200 lbs. dried brewers' grain
12 lbs. salt
8 lbs. bone meal

II. To be fed with fair pasture or with mixed hay consisting of half legumes and half grasses.

5. (18% crude protein)
300 lbs. sweet potato meal
200 lbs. cottonseed meal
7 lbs. salt
5 lbs. bone meal
5 lbs. oyster shell flour

6. (17% crude protein)
300 lbs. sweet potato meal
200 lbs. bran or ground oats
200 lbs. cottonseed meal
9 lbs. salt
6 lbs. bone meal
6 lbs. oyster shell flour

7. (17% crude protein)
300 lbs. sweet potato meal
100 lbs. dried citrus pulp
100 lbs. dried brewers' grain
200 lbs. cottonseed meal
10 lbs. salt
7 lbs. bone meal
7 lbs. oyster shell flour

8. (16% crude protein)
300 lbs. sweet potato meal
200 lbs. rice bran
100 lbs. rice polish
200 lbs. cottonseed meal
12 lbs. salt
8 lbs. bone meal
8 lbs. oyster shell flour

III. To be fed when pasture is very poor or when no legume hay is being fed.

9. (20% crude protein)
400 lbs. sweet potato meal
300 lbs. cottonseed meal
10 lbs. salt
7 lbs. bone meal
7 lbs. oyster shell flour

10. (20% crude protein)
200 lbs. sweet potato meal
100 lbs. ground ear corn with shuck
200 lbs. cottonseed meal
7 lbs. salt
5 lbs. bone meal
5 lbs. oyster shell flour

11. (20% crude protein)
100 lbs. sweet potato meal
100 lbs. molasses
300 lbs. dried brewers' grain
100 lbs. cottonseed meal
9 lbs. salt
6 lbs. bone meal
6 lbs. oyster shell flour

12. (20% crude protein)
200 lbs. sweet potato meal
100 lbs. dried citrus pulp
100 lbs. rice polish
300 lbs. cottonseed meal
10 lbs. salt
7 lbs. bone meal
7 lbs. oyster shell flour

The above rations are listed as suggestions to those wishing to use sweet potato meal in concentrate mixtures for dairy cows. Under the conditions listed each one should give satisfactory results, although there is no special ration that is particularly better than others. When the particular ingredients listed are not available at reasonable prices there are many substitutions that can be made. For example, soybean meal or peanut oil meal can substitute for cottonseed meal, rice polish or hominy for corn, beet pulp for dried citrus pulp, and wheat bran for ground oats. In the using of all the above rations it is best to feed the concentrate mixtures proportionate to the amounts of milk produced by each cow. As a general rule one should feed one pound of grain for each $2\frac{1}{2}$ to 4 pounds of milk produced, with Jerseys getting the narrower ratio and Holsteins the wider one and the other breeds intermediate.

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LOUISIANA BULLETIN NO. 424 DECEMBER, 1947

THE EDUCATIONAL STATUS OF LOUISIANA'S FARM POPULATION

By

T. LYNN SMITH AND LOUISE KEMP

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
MAR 27 1961

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS
W. G. TAGGART, *Director*

TABLE OF CONTENTS

Page

I. SUMMARY 5

II. INTRODUCTION 6

Purposes and Objectives 6

Data and Procedure 7

III. LOUISIANA'S POSITION IN THE NATION 9

IV. VARIATIONS WITHIN THE STATE 16

Residential Differentials 17

Racial Differentials 20

Other Differentials 21

V. PROGRESS 22

Louisiana and the Nation 23

Progress within the State 25

LIST OF TABLES

I. Median School Years Completed by the Population 25 Years of Age and Over, by Race and Residence, Louisiana and the United States, 1940 10

II. Proportions of the Population 25 Years of Age and Over Who Had Completed No School Years, by Race and Residence, Louisiana and the United States, 1940 10

III. Proportions of the Population 25 Years of Age and Over Who Had Completed High School, by Race and Residence, Louisiana and the United States, 1940. 10

LIST OF FIGURES

Figure *Page*

1. Variations in the Amount of Formal Schooling Received by the White Population of the United States Aged 25 Years and Over, By Residence, 1940.... 11

2. Variations in the Amount of Formal Schooling Received by the Negro Population of the United States Aged 25 Years and Over, By Residence, 1940... 12

3. Variations in the Proportions of the White Population of the United States Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940 13

4. Variations in the Proportions of the White Population of the United States Aged 25 Years and Over Who Had Completed High School, By Residence, 1940 14

5. Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed Seven Grades of Schooling, By Residence, 1940.... 17

6. Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed Seven Grades of Schooling, By Residence, 1940 18

7. Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940. 19

8. Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940... 20

9. Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed High School, By Residence, 1940.... 21

10. Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed High School, By Residence, 1940.... 22

11. Relationship of Age to the Average Years of Schooling Attained, By Residence and Race, Louisiana and the United States, 1940.... 24

12. Relationship of Age to the Average Years of Schooling Attained, By Race and Residence, Louisiana, 1940.... 25

THE EDUCATIONAL STATUS OF LOUISIANA'S FARM POPULATION

T. LYNN SMITH AND LOUISE KEMP

I. SUMMARY

1. Whether gauged by the average number of years of schooling, the proportion of persons with no formal education, or the percentages of the population completing high school, the educational status of Louisiana's population is very low in comparison with that of people in the remainder of the nation.

2. The state's poor educational showing is not merely, or even mainly, due to the high percentage of Negroes in its population, although this factor does reduce the averages. If the comparisons are based on data for the white population alone, Louisiana still ranks at the bottom of the list.

3. The state's poor educational showing is due mostly to the inadequate schooling that has been afforded our white rural population. The educational status of the white inhabitants of Louisiana's towns and cities compares favorably with that of their fellow urbanites elsewhere in the nation. But among the white farm populations of the various states, that of Louisiana ranks at the bottom. This category of our population has received an average of only 6.3 years of schooling, almost a year less than the corresponding figure (7.1 years) for Alabama, our closest rival for the cellar position, and 2.7 years below the national average for the white rural-farm population.

4. Louisiana's farm population not only ranks at the bottom of the nation's educational scale, but our farm people are more disadvantaged educationally, in comparison with the inhabitants of towns and cities, than is the case in any other state. In other words, in comparison with the amount of schooling provided our urban people the degree to which the training of our rural-farm population has been neglected is unequalled anywhere else in the United States.

5. The people living in the northwestern part of Louisiana have by far the highest average amount of schooling and those living in the French-speaking sections of south Louisiana have the lowest.

6. For several decades Louisiana has been about keeping pace with the nation in increasing the amount of education given to white urbanites, and has now reached a point where the amount of training given to young white persons in rural-nonfarm areas comes fairly close

to the amount afforded comparable groups in the country as a whole. The educational status of white Louisiana farmers more nearly approximates the national average than was the case several decades ago, but the state will have to accelerate its pace considerably in raising rural educational standards before farm people in the state will reach the levels attained by farmers elsewhere. The state is gaining little headway on the nation in educating its Negroes.

7. Within the state the position occupied by the youthful farmers compares even more unfavorably with that occupied by young people in other groups than is the case among their elders.

II. INTRODUCTION

Purposes and Objectives

This is a study of the educational status of the population of Louisiana. In it we analyze the amount of formal schooling received by the people of the state, compare these attainments with those of the populations in other parts of the Union, examine the variations from group to group and place to place within Louisiana, and study the nature and direction of the changes and trends that are underway. We are particularly interested in the educational standing of the farm people, especially in how the amount of schooling received by them compares with that given to other groups and classes in the population. We want to know if this spread or differential is greater or less than that prevailing in other states and regions. We also desire to identify the factors that are related to the amount of schooling received by farmers and others and to understand the ways in which they operate. It is not merely that we are curious about these and related matters. On the contrary, we believe that such knowledge is necessary in order that measures to correct shortcomings and provide more equal educational opportunities for all may be directed in the most intelligent manner possible. It is earnestly hoped that the data and relationships set forth in this study will contribute to the provision of more equitable and adequate educational opportunities for the state's oncoming citizenry.

The rural sociologist or population analyst need offer no apology for an interest in the educational status of the population. Modern society takes for granted the ability to read well, write legibly, and to make and check rather involved calculations. This is true of persons in all walks of life, not merely those living in towns and cities. If in the small, isolated, and self-sufficient little neighborhoods and communities of half a century ago, many a farmer could get along fairly well with little or no formal schooling, the same certainly cannot be said for his grandson on the farm today. Even in our most rural areas the successful management of a farm requires a considerable amount of schooling on the part of the farm operator. Furthermore, we now know that the rural schools of the nation train fully as many of the future inhabitants of our cities as do the schools of those cities themselves.

For the reasons just enumerated, the educational status of the population has become an important index of its quality. It is a direct reflection of the amount of effort which parents, the members of the community as a whole, and the state are putting forth to insure the well-being of the oncoming generations. Nowadays when the state and the nation do so much to and for the many classes that make up the great society, it is highly important to know the extent to which education—a primary determinant of the quality of the population—is being afforded to the various residential, racial, and cultural groups.

Data and Procedure

The results of the 1940 Census offer the best opportunity we have had for taking stock of the educational attainments of the population. Prior to 1940 only data on illiteracy were gathered. Long ago in the United States the percentages of those who were unable to read and write were reduced so much that the proportion illiterate came to be a very unsatisfactory measure of educational attainments of the people of any given area, race or occupation. Fortunately, in 1940 the regular population schedule contained questions about the number of years of schooling received. The published reports of the census, together with special tabulations that we have had made, make possible a fairly thoroughgoing analysis of the educational achievement of Louisiana's population.

The question on the census schedule referred to the highest, or last full, grade the person had completed in the school system. The possible range is from no grades at all, represented by zero, through five years or more of college, represented by the number 17. We have restricted our study to the educational attainment of adults, or those persons who may be assumed to have completed their training. Most of the data refer to persons 25 years of age and over; but the discussion of the educational status of the population divided into five-year age groups also includes the group aged 20-25 years.

To be most readily understood, these data must be compressed into indexes of one kind or another. Apriori it would seem that one of the best yardsticks of the educational status of a group would be the median number of school years completed. This is the number that divides the group into two equal parts, one half having completed more years and one half having completed less years than the median. Wherever possible we have used this figure as one measure of attainment. "Average" as we use it in this study refers to median years of schooling. From the published tabulations of the Bureau of the Census[1] it was possible to obtain the medians, or average amounts of schooling attained, for the adult populations of the state and nation for both whites and nonwhites properly subdivided into the urban, the rural-nonfarm, and the rural-farm categories.

We supplemented this information by calculating the proportions of persons who have attained specific educational levels (completed no years of school, completed seven grades, completed high school, etc.). On the basis of these indexes, it was possible to make fairly satisfactory comparisons of the status of Louisiana's population with that of the rest of the country.

The analysis of variations within the state was more difficult. Although it is widely recognized that the disparity between the educational attainments of whites and Negroes in the southern states is wide, the data published by the Bureau of the Census are not subdivided by race for any divisions smaller than the states. As a result, these data often reflect little more than the varying proportions of Negroes in the populations of the counties or other divisions. We were anxious to avoid having our studies turn out to be nothing more than crude and expensive ways of demonstrating that the proportion of Negroes in the population varied widely from one part of the state to another. It was necessary, therefore, to procure special tabulations from the Census Bureau, more detailed data which would permit analysis of the educational status of each racial group, before we could proceed with the study of variations throughout Louisiana. The special tabulations made it possible for us to calculate for each of the parishes the proportions of persons who attained specific educational levels, properly subdivided according to race and residence, but it was still not feasible to secure the medians. This was not as serious a defect as we at first thought, because in the course of the study the median proved to be of less use in detecting important variations than some of the other indexes such as the percentage completing high school.

Determination of trends was complicated by the fact that the censuses prior to 1940 secured data solely about the ability of the population to read and write. As indicated above, it was a long step forward when the 1940 Census schedule included queries about the number of years of schooling received. Certainly one should not bemoan the fact that the old tabulations on illiteracy have given way to the new data which are so much more detailed and informing. In the next few decades, it will be possible to determine accurately the rates at which the state and nation are improving their educational standards. For the present, however, we were able to approximate the trends only by comparing the level reached by older age groups in the population, or those persons who completed their training 40 or 50 years ago, with that reached by young adults, or those aged 20 to 24, or 25 to 29 years in 1940. The medians of the number of school years completed by Louisiana's population subdivided into five-year age groups are available in the census publications for nonwhites;[2] these were also calculated for whites in each of the principal residential groups in the state and used as the bases for determining the direction and speed of the changes.

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[1] Those found to be especially useful were: *Sixteenth Census of the United States: 1940,* "Population," Vol. II (Louisiana and United States Summary). Washington: Government Printing Office, 1942.

One shortcoming in the use of this type of data is that they measure quantity, but not quality, of training. Such factors as length of the school year, the type of instruction offered, the qualifications of teachers and the availability of financial resources to carry out the school program are all factors that affect educational achievement. It is important to recognize this fact, especially since these are likely to be most inadequate where the smallest amount of schooling is reported by the population (among Negroes, in rural areas, etc.).

III. LOUISIANA'S POSITION IN THE NATION

One who seeks to determine the relative standing of Louisiana's population with respect to educational status must first divide the data by race and residence. Otherwise, any comparisons are sure to be misleading. As has been the case in so many other studies of the contemporary social scene, after endless statistical manipulations one may succeed merely in demonstrating that the state contains a large proportion of rural folk and a very high percentage of Negroes! These facts are already well known and may be shown in more direct ways. Therefore, in the preparation of our basic tabulations the first consideration was to get the data properly classified according to residence and race.

From among the infinite possibilities in the way of tabulations and graphic representations, and from the hundreds of tabulations and charts actually prepared for purposes of study and analysis, we have selected for presentation in this section only three tables and four maps. These tables and maps contain the basic data from which Louisiana's standing educationally among her sister states may be determined. Table I supplies the data necessary for comparing the median years of school completed by the various residential and racial groups in the state and the nation; Table II provides the facts on which comparisons of proportions with no formal schooling at all may be based; and Table III gives the information about the proportions of the respective residential and racial groups who have received a high school education or better. With

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[2] Bureau of the Census, *Sixteenth Census of the United States*, "Population," Vol. IV (Louisiana and United States Summary). Washington: Government Printing Office, 1943.

TABLE I. Median School Years Completed by the Population 25 Years of Age and Over, by Race and Residence, Louisiana and the United States, 1940*

	Louisiana		United States
	Median years	Rank	Median years
Urban native whites	9.1	37	9.6
Rural-nonfarm native whites	8.1	44	8.6
Rural-farm native whites	6.3	48	8.0
Urban Negroes	5.2	..	6.8
Rural-nonfarm Negroes	3.5	..	5.0
Rural-farm Negroes	2.8	..	4.1

* Source: *Sixteenth Census of the United States: 1940,* "Population," Second Series, Louisiana, p. 27 and Second Series, United States Summary, pp. 34-35.

TABLE II. Proportions of the Population 25 Years of Age and Over Who Had Completed No School Years, by Race and Residence, Louisiana and the United States, 1940*

	Louisiana		United States
	Per cent	Rank	Per cent
Urban native whites	3.2	2	0.8
Rural-nonfarm native whites	10.1	1	1.7
Rural-farm native whites	14.6	1	2.5
Urban Negroes	12.9	.	6.6
Rural-nonfarm Negroes	24.0	.	12.7
Rural-farm Negroes	29.2	.	15.0

* Source: *Sixteenth Census of the United States: 1940,* "Population," Second Series, Louisiana, p. 27 and Second Series, United States Summary, pp. 34-35.

TABLE III. Proportions of the Population 25 Years of Age and Over Who Had Completed High School, by Race and Residence, Louisiana and the United States, 1940*

	Louisiana		United States
	Per cent	Rank	Per cent
Urban native whites	34.3	31	34.6
Rural-nonfarm native whites	23.8	36	25.7
Rural-farm native whites	10.1	42	14.4
Urban Negroes	5.4	..	10.6
Rural-nonfarm Negroes	2.8	..	4.7
Rural-farm Negroes	1.0	..	1.9

* Source: *Sixteenth Census of the United States: 1940,* "Population," Second Series, Louisiana, p. 27 and Second Series, United States Summary, pp. 34-35.

the data for individual states mapped as in Figures 1, 2, 3, and 4, one may easily and consistently determine the residential, racial, and regional variations in educational status. They deserve careful study, and such study will immediately reveal several outstanding distinctions relative to Louisiana's educational status.

In the first place, our citizens must frankly face the fact that the educational status of our population is low, among the lowest in the nation. This lamentable finding stands out irrespective of whether we use median years of schooling, percentage of the population with no schooling, or proportion of persons who have completed high school as the index on which the comparisons are based. Taking, for example, the first of these, we are forced to confess that our people have received, on the average, fewer years of schooling than those of any other state in the Union. We can also determine the factors responsible for our poor showing. Louisiana does not rank low on the nation's educational scale because the white inhabitants of our towns and cities have not had as much formal education as that enjoyed by urban residents in the neighboring states and in the other regions. In fact, the data indicate that there are no great regional differences among the native white urban populations. White people who live in the cities in one section of the country have had about as much schooling as their fellows in any other section. Thus, although our native white population ranks 37th among the 48 states, it still is a well-educated group. The average number of grades completed by those of 25 years of age and over is 9.1, only one half of a year below the national average for the corresponding group. There are few places in the world where the population has received anywhere near this amount of schooling. Those interested in regional aspects will want to know (see Figure 1) that urban whites in Louisiana are about on a par with those of New York and above the standing of the comparable group in New Jersey, West Virginia, Wisconsin, Indiana, Missouri, Rhode Island, Pennsylvania, Kentucky, and Maryland, arranged in descending order. However, Louisiana does not compare favorably with its neighbor, Mississippi, where the 11.7 grades average for the urban native white population topped the nation, nor with Utah, Cali-

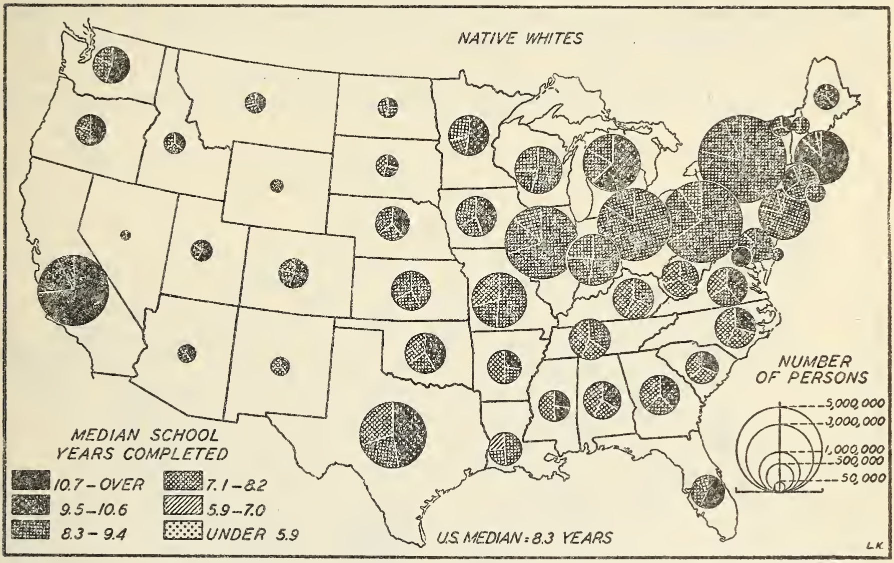

FIGURE 1.—Variations in the Amount of Formal Schooling Received by the White Population of the United States Aged 25 Years and Over, by Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

fornia, Nevada, South Carolina, Florida, North Dakota, and Washington, all of them with an average of 11 years or more.

Nor is Louisiana's low position due in any large measure to the relative standing of its native white rural-nonfarm population. It is true that among persons 25 years of age and over in this category, Louisiana's position is only 44th. Our state ranks below all others except Tennessee, Kentucky, New Mexico, and West Virginia. But the average in Louisiana is 8.1 grades completed, while the national average is only one half of a year more and those of the three leaders, Nevada, Massachusetts, and Utah, only 10.5, 10.4, and 10.1, respectively.

Louisiana's unenviable position educationally among the states is largely due to the very poor showing made by the native white population of her farms. Among persons 25 years of age and over in this category, the average number of years of schooling completed is only 6.3. This is the 48th position among the states, and the average is almost a full year below 7.1 recorded in Alabama, the second lowest state. It is 2.7 years lower than the national average for the category, and more than three years below the averages of the two leaders, Massachusetts and Utah, which are 9.8 and 9.4, respectively.

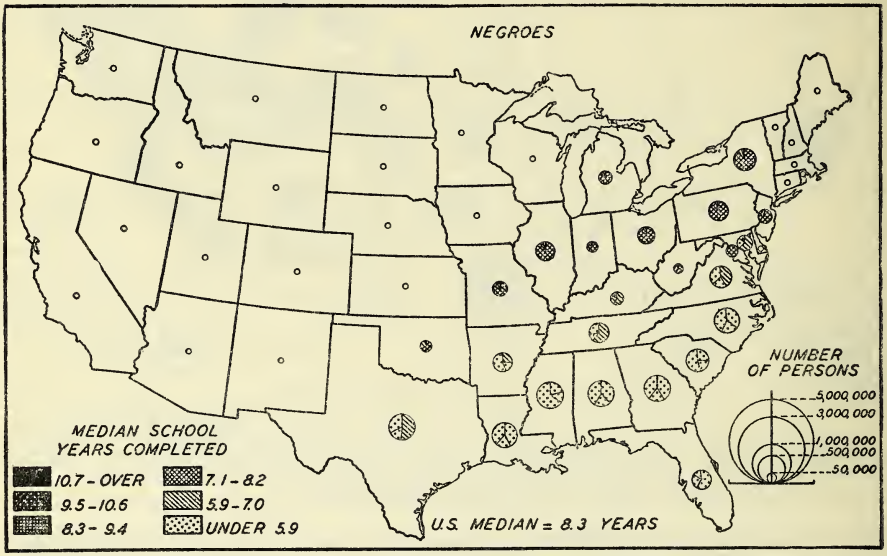

FIGURE 2.—Variations in the Amount of Formal Schooling Received by the Negro Population of the United States Aged 25 Years and Over, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

These conclusions would not be altered in any fundamental way if they were based on the proportions of persons who had never completed the first grade, although on this score the showing of the urban population is not as good as it is when median years of school completed are considered. The 3.2 per cent of our urban native white population, 25 years of age and over, who had not completed the first grade, compares most unfavorably with the 0.8 per cent in the nation, and is higher than that of any other state except New Mexico. Even New Mexico, with its large Spanish-American population included in the native white category, does not keep Louisiana's native white rural-nonfarm and rural-farm populations from occupying the most unfavorable position among the states. The 10.1 per cent of our white rural-nonfarm population with no schooling looks bad alongside the national average of 1.7 per cent; and the 14.6 per cent of Louisiana's white farm population who have had no schooling makes an even poorer showing with the nation's 2.5 per cent. As late as 1940, on the eve of the Atomic Age, one out of seven of Louisiana's white farmers and their wives had never completed the first grade of school.

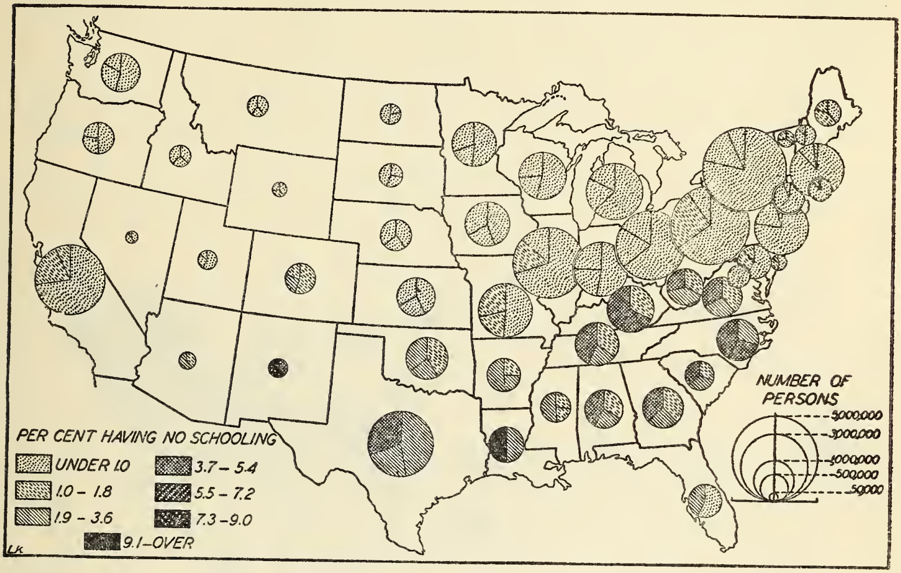

FIGURE 3.—Variations in the Proportions of the White Population of the United States Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

The very low educational status of the Negroes is another important factor in our poor educational standing. This fact is strongly emphasized by the graphical devices employed in this study. The urban, rural-nonfarm and rural-farm Negroes of Louisiana, along with those living in other southern states, make a very poor showing, not only in comparison with the native white populations of comparable residential categories, but also in comparison with the urban Negroes of the northern states. (See Figure 2.) The median of 5.2 grades completed by Louisiana's urban Negroes stands third from the bottom among the 48 states, below all of the others except Georgia and South Carolina. It is 1.4 grades below the national average of 6.8.

The position of Louisiana's rural-nonfarm Negroes is even worse. The median for this group is only 3.5 years, the very lowest in the nation, 0.3 of a year below that of the next state, South Carolina, and a full year and one half below the national average for the class.

Rural-farm Negroes are not sufficiently numerous outside the South to justify ranking the states, but in any case Louisiana would not make a showing of which to be proud. In this state the rural-farm Negroes averaged only 2.8 grades, almost a full year below the next lowest ones, Georgia, South Carolina, and Alabama, and 1.3 years below the national (almost exclusively the southern) average.

As in the case of the native whites, to make the comparisons on the basis of the proportions of persons who have never completed the first grade gives results fully as unfavorable for the state. In all residential categories the percentage of Louisiana's Negroes who have no schooling

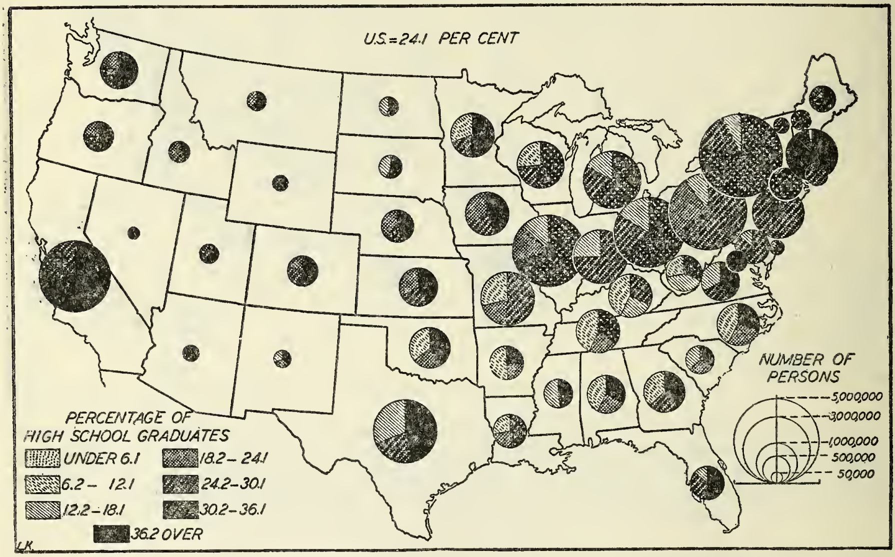

Figure 4.—Variations in the Proportions of the White Population of the United States Aged 25 Years and Over Who Had Completed High School, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

is about double that for the nation as a whole. In the urban category, the percentage among Louisiana's Negroes is the highest in the nation. Among the rural categories, the percentage of Louisiana's Negroes is much higher than in any of the other southern states, the only ones with sufficiently large Negro populations to permit significant comparisons to be made.

Louisiana's farm population not only ranks at the bottom of the nation's educational scale, but the spread between the amount of schooling they have been privileged to receive and that afforded their fellows in the towns and cities is the widest in the nation. In fact, this discrepancy between the amount of education acquired by the inhabitants of Louisiana's towns and cities and those who live on her farms is one of the most significant findings of this study. This is a matter that should be of concern to every person who cares about the well-being of the state, for there is no comparable differential in any of the other states of the nation. As may be seen from Figure 1, in Ohio, New York, and New Jersey the people living on farms have been given about the same amount of formal training as have those who live in urban centers. Throughout the entire Midwest the educational attainments of the farm population approach those of people living in cities. In the West and in Massachusetts there is a slight differential only because even the high level attained by the farmers is surpassed in the urban centers. But in the South the unfavorable situation of the farm population stands out. The relatively high educational status of its urban population accompanied by a low educational status of the rural-farm population is the outstanding characteristic of the region. This deplorable situation is most acute of all in Louisiana. It strikes the eye all the more because the urban level as well as the rural-farm are so much below those of the other southern states.

That the inequality of educational opportunities is greater in Louisiana than in most other states in the Union also exhibits itself in other forms than this rural-urban differential that has just been mentioned. Careful study will show that our rating is better if the proportions of persons receiving a high school education or more are used as the index, than it is if either the median years of schooling or the per cent receiving no schooling at all is employed. (See Table III.) This situation is one that would occur if a selected portion of the population were benefiting from comparatively good educational opportunities, while larger numbers were finding it difficult or impossible to continue their schooling. In other words, evidence suggests that the Louisiana family in poor circumstances finds it more difficult to keep its children in school until their secondary education has been completed than is the case elsewhere.

The data and analysis presented in the preceding paragraphs leave no doubt that the educational status of our population, in comparison with that of the other states in the Union, is nothing of which to be proud. Nor can we better our case by asserting that we have high proportions of rural people and of Negroes, whose educational status pulls the state average down. Even when racial and residential differences are properly accounted for by comparing Louisiana's urban whites with the same category elsewhere, rural-farm whites with rural-farm whites, urban Negroes with urban Negroes, rural-farm Negroes with rural-farm Negroes, etc., the state's poor showing persists. Our people of all residential and racial groups have been receiving relatively little formal schooling. Furthermore, our state is in a class of its own from the standpoint of the great differential in the amount of schooling received by the urban population and by the rural. Nowhere else in the nation does the farmer compare so unfavorably with the townsman and the city dweller as in Louisiana.

IV. VARIATIONS WITHIN THE STATE

The educational status of the population varies tremendously from one part of Louisiana to another. To a considerable extent these are merely reflections of the facts previously indicated, namely, that urban people have been privileged to receive more schooling than those who live in rural districts, and that white people have been afforded better educational opportunities than Negroes. But among members of each of the races who fall in any one of the three residential categories the differences in educational status vary widely from one section of the state to another. For the white farmer as well as the Negro agriculturist, the accident of birth in one part of the state has exerted a great influence upon the amount of schooling he was privileged to obtain; and the same has held for those born in the towns and cities. This indicates that not only race and residence but other factors as well are related to the educational status of the population. To a determination of the precise nature of the variations and an identification of the factors which are responsible for them, this section is devoted. Since residence and race are known to be such powerful determinants, they must be taken into account from the very beginning.

In order to get a bird's-eye picture of how educational status among urban and rural people, of each race, varies throughout Louisiana, Figures 5 to 10 were prepared. Two of these, one for the white population and the other for the Negro, utilize the proportions having completed seven or more years of schooling as a basis for comparing the educational status of the people of one parish with that of their fellows in other parts of the state. Another pair is based upon the percentage of the population with no schooling at all, and the third uses the proportion of high school graduates as the yardstick for making the comparisons. Because the data are subdivided by race as well as residence, and because all three indexes are employed, a study of these six maps reveals the principal variations in the educational status of the population of Louisiana.[8]

Residential Differentials

We have already indicated that the nation-wide tendency for more education to be provided urban people than is given to the inhabitants of rural territory also prevails in Louisiana. In fact, we have demonstrated that the disadvantage of the farm population is at its maximum in this state. Now it merely remains to be shown that this condition pre-

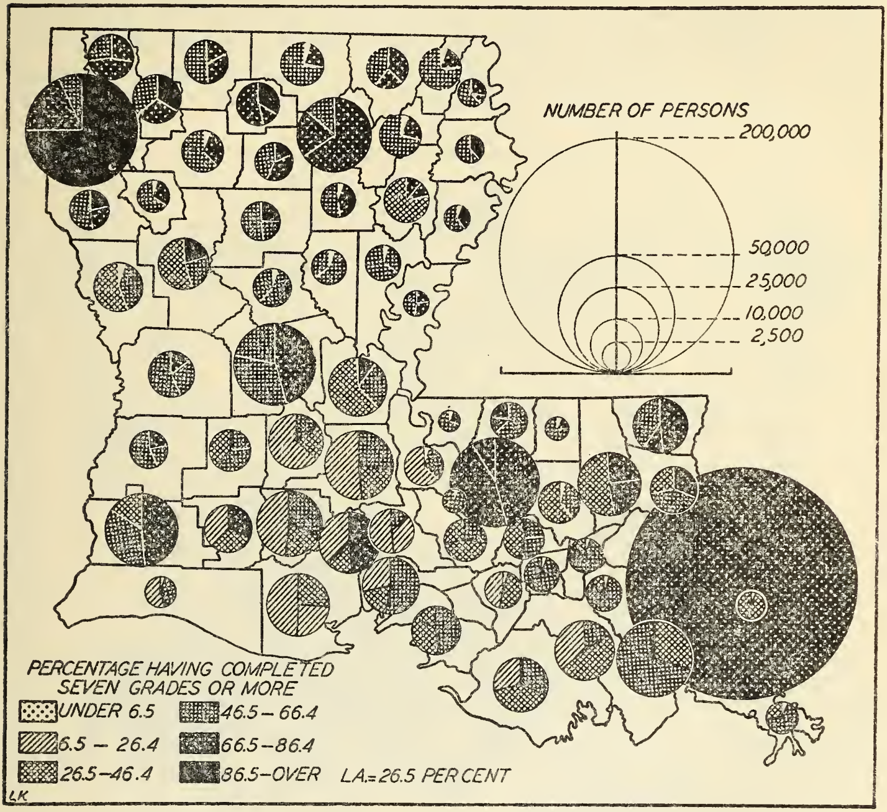

FIGURE 5.—Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed Seven Grades of Schooling, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

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[8] For detailed data by parishes, see Louise Kemp and Homer L. Hitt, "Educational Data for Parishes of Louisiana," Mimeographed Series 1, Department of Rural Sociology, Louisiana Agricultural Experiment Station, Baton Rouge, August, 1947. These tables were prepared because published reports of the United States Bureau of the Census do not give parish data for the races separately.

vails throughout all portions of the state. Observation of Figures 5 to 10 indicates that the unfavorable educational position of the rural-farm population prevails in all parts of Louisiana. Consider the data for the white population.

In the state as a whole in 1940 three-fourths (73.1 per cent) of all adult urban whites had completed at least seven grades of school. Among rural-nonfarm population the corresponding percentage was 58.4, but in the rural-farm population it was only 41.9. Although the educational status of urban people, villagers and suburbanites, and farmers varies greatly from one part of the state to another, there is one uniformity that is state-wide. This is the unfavorable position of the farmers compared with the others. In every one of the 40 parishes containing urban populations except East Feliciana, the farmers are the lowest of the three groups in educational attainments. In the other 23

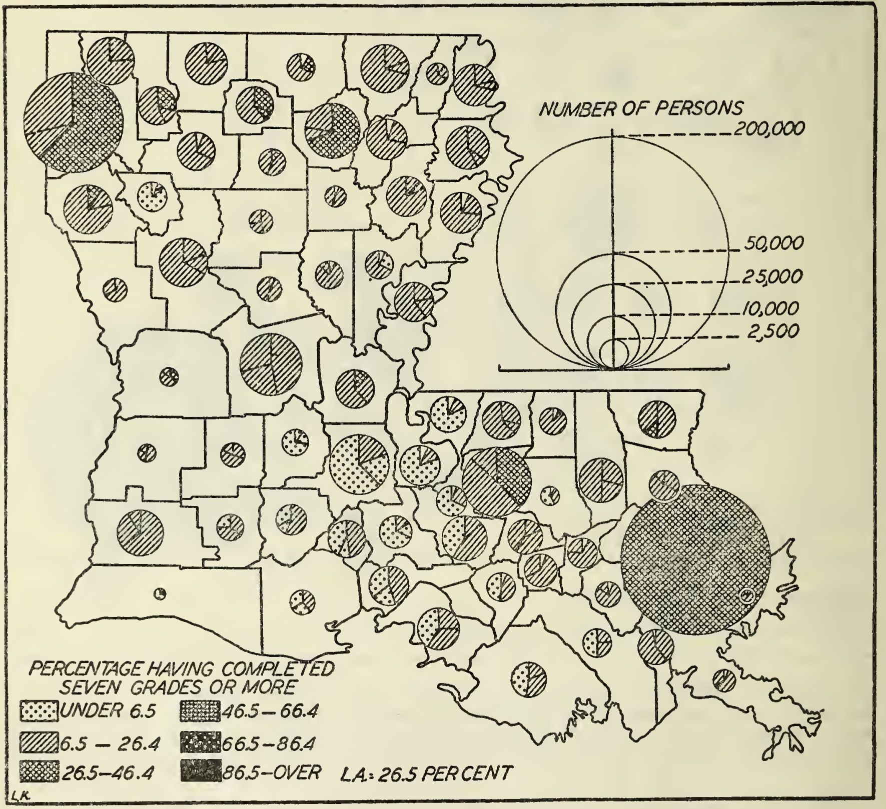

Figure 6.—Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed Seven Grades of Schooling, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

parishes (Orleans is all urban), the farm population ranks below the rural-nonfarm.

Similar are the results if the comparisons are based on data showing the percentages of the population with no schooling at all, or on the proportions graduating from high school. In the deltas as in the hills; in the sugar bowl, the rice area, the cotton sections, and the areas where truck and dairy farming prevail; in French Louisiana and in the Anglo-Saxon portions of the state; in north central Louisiana, where the educational status of the population is comparatively high, and in south central Louisiana, where it is very low; in all parts of our exceedingly heterogeneous state, the differences are the same—the people who live on the farms have received far less schooling than those who live in the villages, towns, and cities.

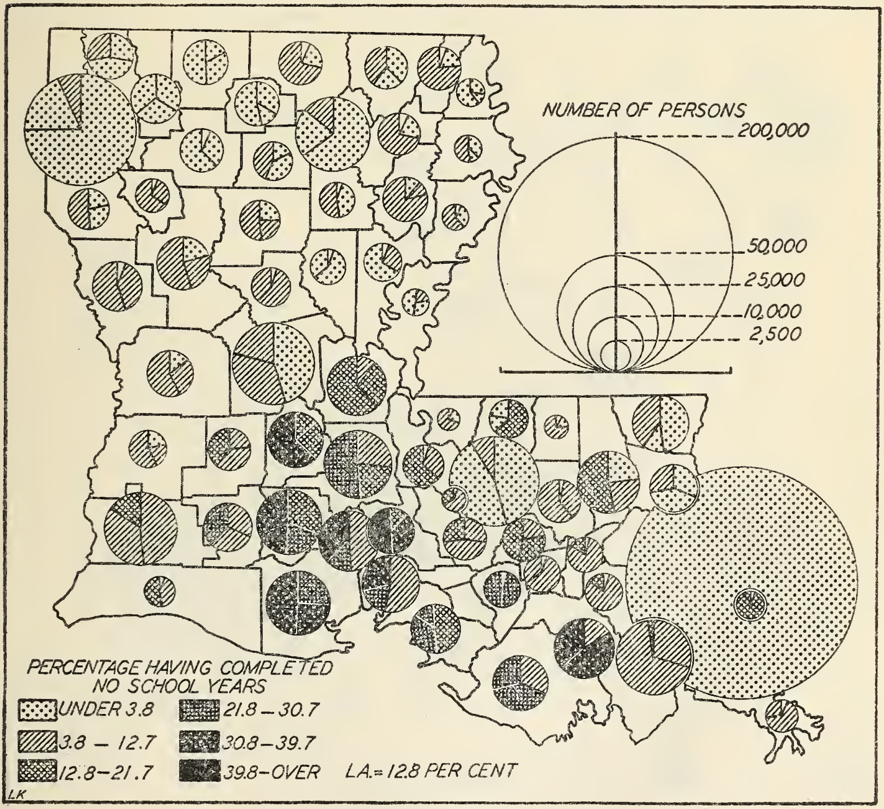

Figure 7.—Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

Similar is the showing of the rural Negro in comparison with his urban fellow. On each of the indexes, amid all the varied situations found within the borders of Louisiana the country people of a given parish have received less formal schooling than the residents of the towns or cities in the same parish.

Racial Differentials

Few comments are necessary about the racial differences in the educational status of the population of Louisiana. The facts evidenced by comparing Figure 5 with Figure 6, Figure 7 with Figure 8, and Figure 9 with Figure 10, show that the difference is considerable and clear-cut. Whatever index is employed, in rural districts as in towns and cities, and in all sections of Louisiana, the educational status of the Negro population is vastly inferior to that of its white fellows.

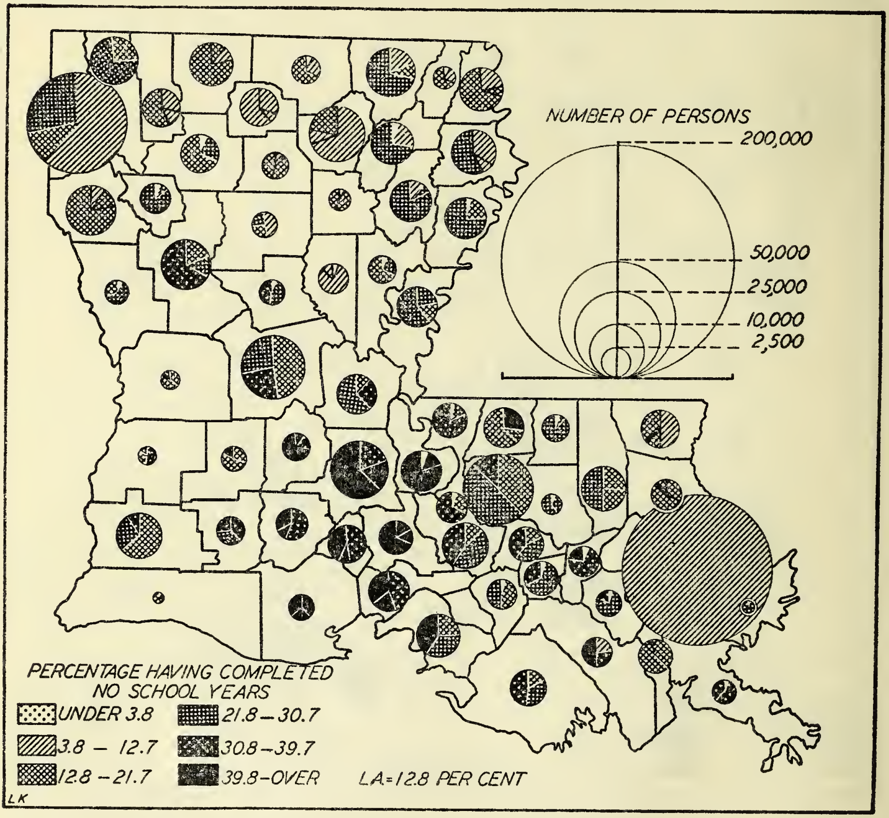

FIGURE 8.—Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed No School Years, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

Other Differentials

Even after rural-urban and racial differentials are properly accounted for, some other significant variations remain. The most important of these are the comparatively high educational status which prevails in north central and northwestern Louisiana, and the extremely low educational attainments of the population in the French-speaking sections of south Louisiana. Roughly, the French cultural area of Louisiana is included in the triangle formed by a straight line running from the southwestern tip of the state to the point where the east-west boundary of Louisiana and Mississippi ends at the Mississippi River, another straight line extending from that point through New Orleans to the Gulf of Mexico, and by taking the Louisiana coast as a base. To one familiar with the distribution of races and cultures in Louisiana the associations revealed by Figures 5 to 10 are clear-cut and unmistakable.

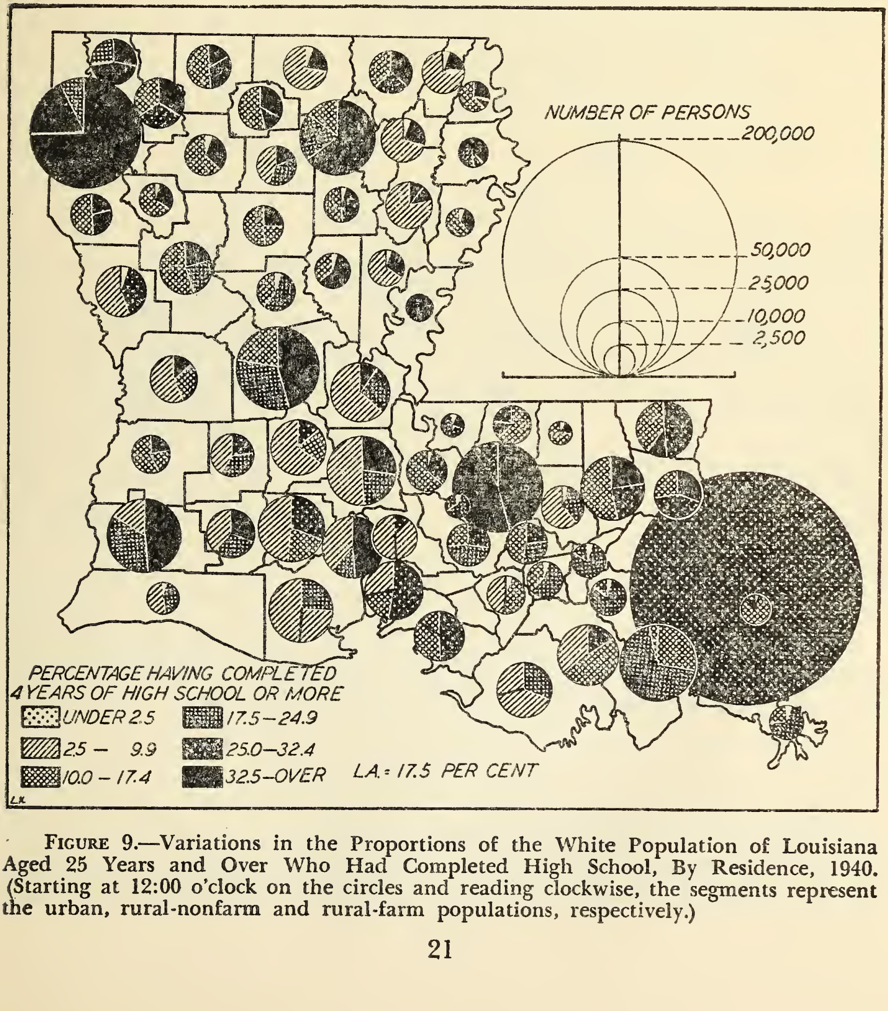

FIGURE 9.—Variations in the Proportions of the White Population of Louisiana Aged 25 Years and Over Who Had Completed High School, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

There is a definite association between the population of French language and French culture and low educational status. Moreover, the educational standing of the population is lowest in those particular parts of the French section in which the Acadian influence has been the greatest. More than any other factor this contributes to Louisiana's poor national standing, just as the Spanish-speaking population of New Mexico is responsible for that state's low ranking educationally.

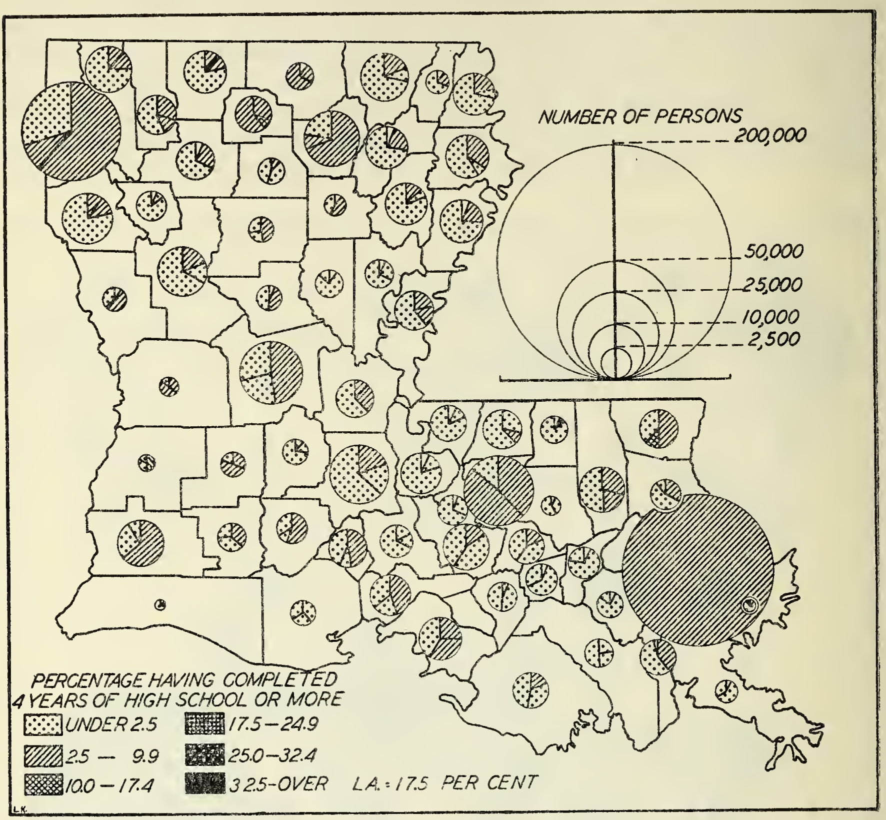

FIGURE 10.—Variations in the Proportions of the Negro Population of Louisiana Aged 25 Years and Over Who Had Completed High School, By Residence, 1940. (Starting at 12:00 o'clock on the circles and reading clockwise, the segments represent the urban, rural-nonfarm and rural-farm populations, respectively.)

V. PROGRESS

There is little doubt that the educational status of the population is improving. But, since prior to 1940 we have no information on years of schooling completed, we can measure this improvement only by comparing the levels attained by young persons, or those who have completed their training fairly recently, with the levels reached by persons who finished their schooling five or six decades ago. Figures 11 and 12 were prepared to show the trends in educational progress in the state and in the country as a whole.

It is apparent from these figures that young people, in cities, villages and suburban areas, and on farms, have the advantage over their parents and grandparents as far as average amount of schooling is concerned. The increased achievement is particularly noticeable among persons aged 40 years and less, or those who received their training since the public school system was organized.

Louisiana and the Nation

Figure 11 enables us to compare the educational progress made in Louisiana with that made by the nation as a whole. It shows that during the last half century the rate of improvement among white people of the state has been more rapid than that made in the country, with the result that the gaps between the educational levels reached by Louisianians and people who live in the rest of the country are being closed. Negroes of the state, however, seem to be making little headway in approaching the national average for their race.

As far as white city residents are concerned, the gap has been closed for some time. Even among persons aged 65 years and over the residents of the state did not fall far short of those in the nation, and for some time now Louisiana has been about keeping pace with the country as a whole in educating her urban population. The state has likewise reached a point where the training given to young village and suburban dwellers compares at least not too unfavorably with that of the comparable group in the nation as a whole. Some progress is being made toward giving the state's white farmers the necessary training that will enable them to hold their own with farmers elsewhere. This is indicated by the fact that the average educational attainment of Louisiana farmers aged 65-70 years failed by 3.3 years to meet the national average for these ages, whereas among persons aged 20-25 years the difference between state and national averages amounted to 1.4 years. However, the goal is still far from attained. The differential between Louisiana farmers and those of the nation is especially important because it is found even in the youngest age groups. The educational level of persons aged 20-25 years in 1940 will influence the general educational picture in the state for a long time to come, and it is only as these persons are replaced by succeeding generations that are better trained can the state hope to reach the average educational attainment of the farmers in the nation.

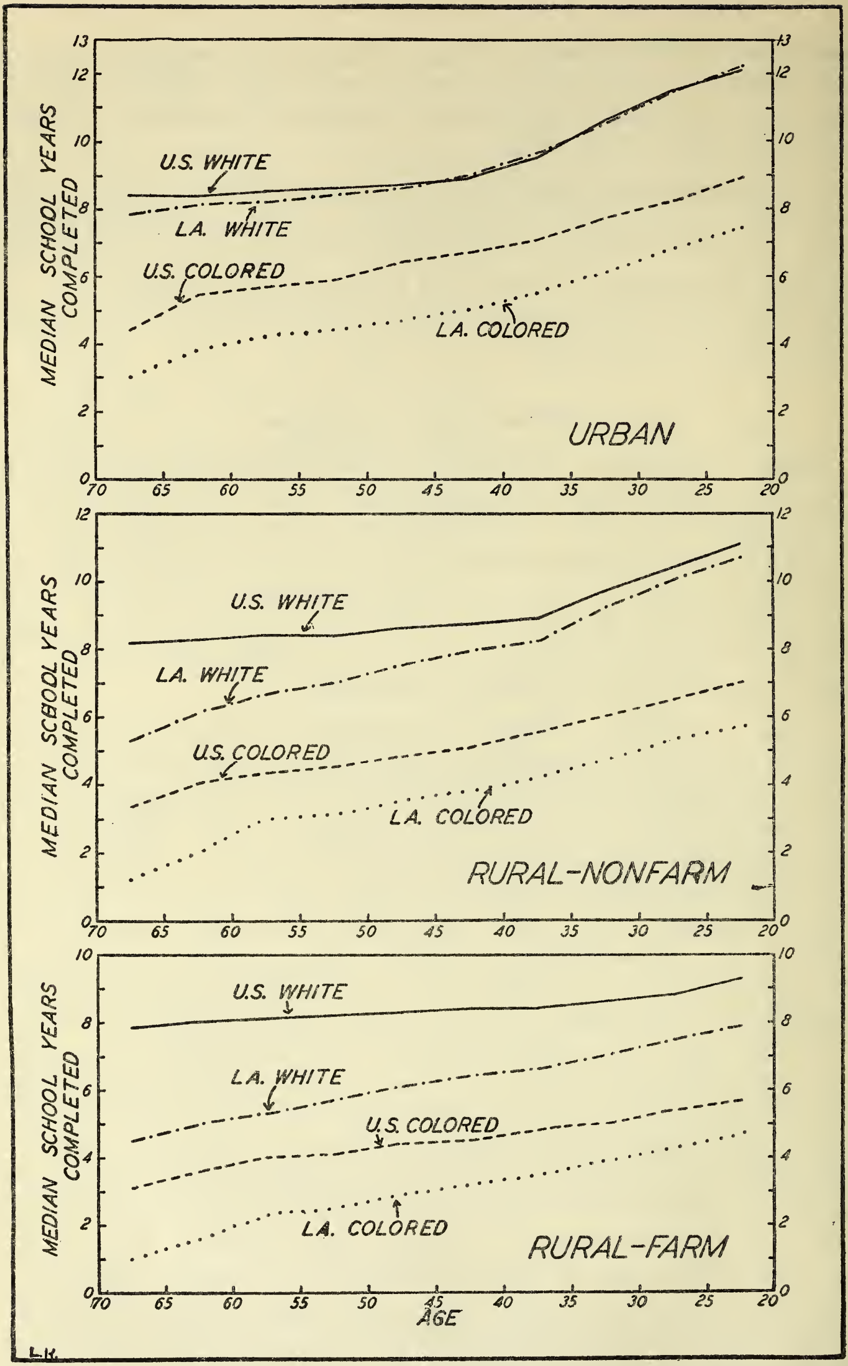

FIGURE 11.—Relationship of Age to the Average Years of Schooling Attained, By Residence and Race, Louisiana and the United States, 1940.

Progress within the State

The extent to which the amount of formal schooling has increased among the different groups which make up Louisiana's citizenry is shown in Figure 12. Urban residents aged 20-25 years in 1940, both white and colored, averaged more than four years of training above the amount

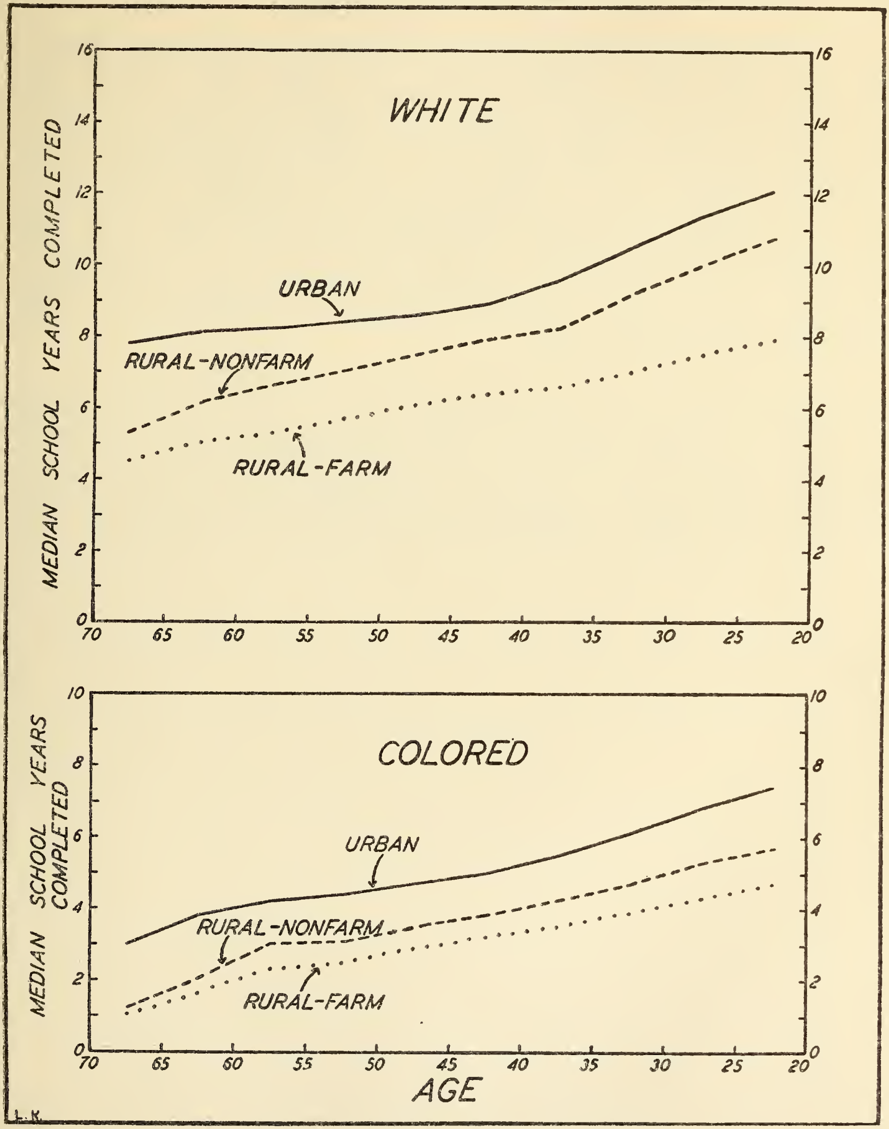

Figure 12.—Relationship of Age to the Average Years of Schooling Attained, By Race and Residence, Louisiana, 1940.

reported by urbanites aged 65-70 years at that time. The median years of schooling reported by rural-nonfarm persons aged 20-25 years likewise exceeded by more than four years the amount reported by persons aged 65-70 years who were living in rural-nonfarm areas. The improvement of the educational standing of young farm people in comparison with that of their elders is not as marked. Here the differences amount to only 3.4 years for whites and 3.7 years for Negroes.

The educational level of Louisiana farmers, both white and colored, was lower than that of other groups in the state half a century ago; at the present time the gap between the amount of training reported by farmers and persons living elsewhere, instead of being lessened, is actually wider than ever. The white farmer of the state aged 65-70 years in 1940 had received, on the average, 3.3 years of schooling less than had the urban resident in the same age group; farm people aged 20-25 years had received, on the average, 4.2 years less than their contemporaries in the cities of the state. This is just as true of the Negro farmer, whose standing comes no closer to that of the Negroes in the towns and cities than that of his parents did.

The implications of these facts are clear. If Louisiana is to better her rank educationally, she must look first of all to her rural schools. The gap must be closed between the educational opportunities offered to citizens of the state who live in the country and those who live in towns and cities. The big task confronting Louisiana, and the Southern Region, is to increase the amount of schooling secured by rural people.

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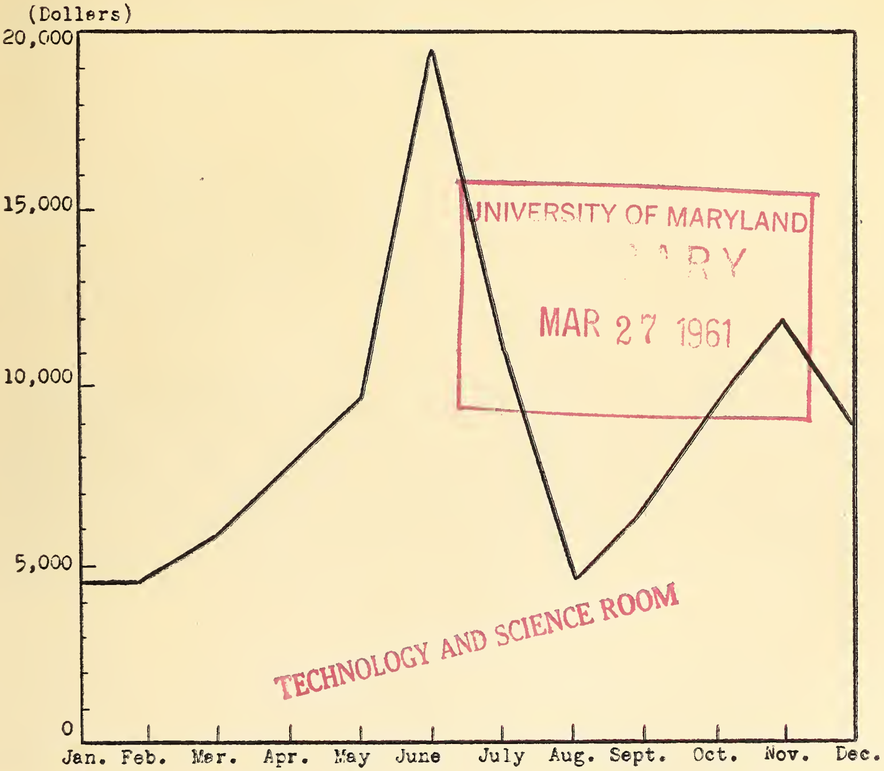
PRODUCTION AND MARKETING OF FRUITS AND VEGETABLES IN THE BATON ROUGE TRADE AREA IN 1946

By

F. E. STANLEY, R. B. JOHNSON, AND M. D. WOODIN



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MONTHLY SALES OF FRUITS AND VEGETABLES BY 35 LOCAL GROWERS
SELLING IN BATON ROUGE, 1946

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

PRODUCTION AND MARKETING OF FRUITS AND VEGETABLES IN THE BATON ROUGE TRADE AREA IN 1946[1]

F. E. STANLEY, R. B. JOHNSON, AND M. D. WOODIN

INTRODUCTION

Metropolitan Baton Rouge has grown rapidly in recent years and has become an important center for industry, business, education, and government. However, the growth of the city has not been accompanied by proportionate increases in some of the public facilities and services needed to serve the people adequately. Prominent among those lagging behind are facilities for effectively marketing fresh farm produce, such as fruits, vegetables, poultry, and eggs. Although most population centers of comparable size have facilities, either publicly or privately owned, where farm produce is bought and sold, Baton Rouge has no organized produce market.

Recognizing the need for an organized produce market, civic groups in Baton Rouge made a request for a study to develop information which would serve as a basis for appraising the present system of handling fresh produce and to determine the feasibility of establishing a centralized produce market in the city.

Purposes of the Study

The major purposes of the producers' survey were to obtain data on the variety and volume of production of fruits and vegetables in the nine-parish trade area;[2] to secure information on present marketing practices and trade outlets; to study the seasonal pattern of production and marketing; to ascertain the possible benefits which might be derived from a produce market in Baton Rouge; and finally, to evaluate the potentialities of the area as a year-round source of supply of fruits and vegetables.

Procedure

A field survey of fruit and vegetable growers was made in the nine parishes comprising the Baton Rouge trade area in the spring of 1947. In an effort to obtain data from every grower selling in the Baton Rouge market, a list of names of growers was compiled after interviews with county agents, Baton Rouge wholesalers and retailers, and growers in each community of the trade area.

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[1] This report primarily concerns fruit and vegetable production and marketing by local growers, and is part of a study of the Baton Rouge produce trade. Cooperating in the over-all study were the Louisiana Market Commission, the Louisiana Agricultural Extension Service, and the Marketing Facilities Branch of the Production and Marketing Administration, U.S.D.A.

The authors wish to express their appreciation to Dr. B. M. Gile, whose criticism and suggestions improved the manuscript.

[2] For the purposes of this study, the Baton Rouge trade area is considered to include the parishes of Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, West Baton Rouge, and West Feliciana.

Although detailed information was obtained from 78 growers, only 35 were found who sold a variety of fruits and vegetables in Baton Rouge in 1946. Forty-three of the 78 growers interviewed did not market any of their produce in Baton Rouge. It is estimated that more than 80 per cent of the growers selling in Baton Rouge on a year-round basis were included in the survey. In addition to these growers, there are probably 25 others who sell in Baton Rouge one or two commodities, such as sweet potatoes or Irish potatoes, in season. It was impractical to include these growers in the survey.

Other data on local fruit and vegetable supplies and volume of consumption were obtained from the City-Parish Planning Committee, railroad officials, wholesalers, and retailers.

IMPORTANCE OF BATON ROUGE AS A CONSUMPTION CENTER FOR FRESH FRUITS AND VEGETABLES

The importance of Baton Rouge as a consumption center for fresh fruits and vegetables is indicated by its population. The City-Parish Planning Committee estimates the population of East Baton Rouge Parish to be approximately 115,000, of which about 80 per cent, or 92,000, live in Baton Rouge and adjacent areas. To this may be added the population of a number of nearby suburban communities which would give a total of approximately 100,000 persons in the metropolitan area.

From information obtained from wholesalers, retailers, and railroad officials, it is estimated that in 1946 the equivalent of 2,000 carloads of fresh fruits and vegetables was handled on a wholesale basis in Baton Rouge. Of this total about 85 per cent, or 1,700 carloads, were handled by Baton Rouge wholesalers and one chain store warehouse. The remaining 15 per cent, or 300 carloads, were purchased by retailers, restaurants, hotels, and consumers directly from local growers, truckers and out-of-city wholesalers.

Wholesalers estimate that the equivalent of 340 carloads was shipped to retailers in the outlying trade area, and approximately 1,660 carloads of fresh fruits and vegetables were consumed in the Baton Rouge metropolitan area in 1946.

SOURCES OF FRESH FRUITS AND VEGETABLES CONSUMED IN BATON ROUGE METROPOLITAN AREA IN 1946

Of the 1,660 carloads of fresh fruits and vegetables consumed in Baton Rouge in 1946, the equivalent of 1,535 carloads was shipped into the city from more distant production areas, and 125 carloads, or about 8 per cent of local consumption, were supplied by local growers.

The 1,700 carloads of fresh fruits and vegetables handled by Baton

Rouge wholesalers in 1946 were divided almost equally between railroad and truck receipts. Railroads brought in 809 carloads, or 48 per cent of the total (Table I). The remaining 891 carloads, or 52 per cent, were truck receipts. Of the 2,000 carloads handled by all dealers, however, truck receipts accounted for 1,191 carloads, or 60 per cent of the total.

TABLE I. RAIL UNLOADS OF FRUITS AND VEGETABLES IN BATON ROUGE, BY MONTHS, 1946

MONTH	Irish potatoes	Other fresh fruits and vegetables	Total	Per cent of total
	Carloads			
January	46	30	76	9.4
February	38	17	55	6.8
March	40	31	71	8.8
April	14	43	57	7.0
May	15	32	47	5.8
June	5	41	46	5.7
July	12	46	58	7.2
August	24	66	90	11.1
September	26	66	90	11.4
October	22	63	85	10.5
November	22	41	63	7.8
December	33	36	69	8.5
Totals	297	512	809	100.0

Source: Louisiana and Arkansas, Missouri Pacific, and Illinois Central Railroads.

PRODUCTION AND MARKETING OF FRESH FRUITS AND VEGETABLES IN THE BATON ROUGE TRADE AREA

The importance of the farms in the Baton Rouge trade area as a potential source of supply of fresh fruits and vegetables for the local market is indicated in Table II. In the nine-parish area, almost 34,000 acres were devoted to fruit and vegetable production, with a value of more than three and one-quarter million dollars in 1944. This represents the equivalent of about 2,225 carloads, or between 500 and 600 carloads more than was consumed in Baton Rouge in 1946.

A considerable proportion of the 1,660 carloads of fresh fruits and vegetables consumed in the city in 1946 consisted of such items as oranges, bananas, apples, lemons, and other fruits not produced in this area. However, the fact remains that there exists in Baton Rouge a sizable demand for fresh produce which could be supplied to a large extent by local growers to the mutual benefit of dealers, consumers, and producers in the Baton Rouge area.

TABLE II. NUMBER OF FARMS AND ACREAGE OF SELECTED VEGETABLES IN NINE PARISHES OF THE BATON ROUGE TRADE AREA, 1944

COMMODITY	TOTAL		ASCENSION		EAST BATON ROUGE		EAST FELICIANA		IBERVILLE	
	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage
Irish potatoes	7,689	13,467	851	1,592	970	1,124	1,318	1,476	272	391
Sweet potatoes	7,679	8,600	833	974	1,012	1,029	1,370	1,258	226	233
Beans, green*	2,998	5,447	517	929	136	125	282	342	29	17
All other vegetables and melons*	1,796	3,725	349	674	151	231	51	159	47	207
Strawberries	1,438	1,776	361	337	10	6	1	2	0	0
Cabbage*	168	352	28	24	63	66	7	102	22	26
Tomatoes*	200	228	28	10	71	34	4	12	30	21
Peas, green*	95	177	29	22	14	4	1	15	11	6
Corn, green*	62	81	8	8	15	9	3	26	17	21
Totals	......	33,853	......	4,570	......	2,628	......	3,392	......	922

COMMODITY	LIVINGSTON		POINTE COUPEE		ST. HELENA		WEST BATON ROUGE		WEST FELICIANA	
	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage	Number of Farms	Acreage
Irish potatoes	1,078	774	1,451	4,681	841	605	309	838	599	7,686
Sweet potatoes	1,122	1,074	1,100	867	923	578	237	140	856	2,438
Beans, green*	1,057	1,589	1	†	938	2,365	16	11	22	69
All other vegetables and melons*	507	677	386	715	179	276	97	172	29	614
Strawberries	897	1,269	0	0	168	162	0	0	1	†
Cabbage*	15	27	0	0	10	23	18	15	5	69
Tomatoes*	18	8	2	2	25	6	20	8	2	127
Peas, green*	13	10	6	12	14	4	5	3	2	101
Corn, green*	3	1	1	†	10	7	5	9	0	0
Totals	......	5,429	......	6,277	......	4,035	......	1,196	......	5,404

Source: 1945 Census of Agriculture.
*Includes only acres harvested for sale.
†One-half acre or less.

Baton Rouge has the somewhat unique situation of being located adjacent to large commercial vegetable producing areas which ship out most of their produce, and at the same time is a relatively large fruit and vegetable consuming center shipping in practically all of these commodities. There are several possible explanations of this production-consumption paradox. Most of the local producers believe that the absence of a common meeting place for buyers and sellers underlies much of this difficulty, and that a produce market would solve many of their marketing problems. Other reasons are the shortage of labor for peddling produce from store to store, and the practice on the part of existing marketing agencies of shipping most of their produce to established outlets in northern markets.

Market Outlets

The main marketing outlets for growers in the trade area are farmers' cooperative shipping associations, private produce dealers and shippers, trucker-buyers, and canning plants. Minor outlets include produce brokers and small-lot receivers in central markets, the New Orleans French Market, and wholesale and retail buyers in Baton Rouge and other towns in the area.

Production and Marketing Practices in Important Sub-Areas

The important centers of fruit and vegetable production in the Baton Rouge trade area are those surrounding Gonzales, Denham Springs, Plaquemine, St. Francisville, New Roads, and Montpelier. The crops grown and marketing practices employed in each of these areas are discussed briefly below.

Gonzales Area. Strawberries, snap beans, and shallots are the three important fruit and vegetable crops in the Gonzales area of Ascension Parish. The strawberries and snap beans are shipped largely through a farmers' cooperative association and private shippers. The shallots are sold mostly to local shipper-buyers.

Denham Springs Area. Strawberries and snap beans are the important truck crops in the Denham Springs area of Livingston Parish. A large part of these commodities is shipped through private dealers in Denham Springs.

Plaquemine Area. Shallots are the most important vegetable crop in the Plaquemine area of Iberville Parish. Most of the shallots are moved by private shippers. Several small diversified vegetable farms are found within a five-mile radius of Plaquemine, and most of the produce from these farms is sold to retail stores in the town.

Pointe Coupee Area. Irish potatoes, onions, and cabbage are the principal vegetable crops produced commercially in the New Roads area of Pointe Coupee Parish. The greater part of these vegetables is sold to truckers and private shippers. A considerable acreage is planted to sweet potatoes in this area, but the bulk of the crop is for farm and home use.

St. Francisville Area. The most important vegetable crop in the St. Francisville area of West Feliciana Parish is sweet potatoes. Most of the crop is marketed through private shippers, truckers, and canning plants.

St. Helena Area. Snap beans, strawberries, green peppers, cucumbers, and squash are the leading commercial truck crops in the Montpelier area of St. Helena Parish. The bulk of these fruits and vegetables is sold to private shippers and truckers.

Almost 70 per cent of the total receipts from produce on the 43 farms not selling in Baton Rouge was accounted for by strawberries and snap beans. These farms were considerably smaller than those that produced for the Baton Rouge market. Vegetable acreage averaged 11 acres per farm, as compared with 19 for the growers who sold in Baton Rouge. Vegetable producers in these outlying areas are an important potential source of supply for a produce market in Baton Rouge.

PRODUCTION AND PRACTICES OF GROWERS MARKETING PRODUCE IN BATON ROUGE IN 1946

Location of the Farms

Thirty-five of the 78 fruit and vegetable growers interviewed marketed produce in Baton Rouge in 1946. Practically all of their production was sold in the city. These 35 producers were found in five parishes: Ascension, East Baton Rouge, Iberville, Livingston, and St. Helena. No producers marketing regularly in Baton Rouge could be found in the parishes of East Feliciana, Pointe Coupee, West Baton Rouge, and West Feliciana.

The distances of the 35 farms from Baton Rouge are shown in Table III. Four-fifths of the growers were within 25 miles, and only two growers were beyond 30 miles of the city.

TABLE III. Distance from Baton Rouge of 35 Fruit and Vegetable Farms Selling Produce in Baton Rouge in 1946

Number of Miles Farm is from Baton Rouge	Number of growers	Per cent of total	Cumulative total of percentages
0.5– 5.0	4	11.4	11.4
6.0–10.0	10	28.6	40.0
11.0–15.0	4	11.4	51.4
16.0–20.0	8	22.8	74.2
21.0–25.0	2	5.7	79.9
26.0–30.0	5	14.3	94.2
31.0–35.0	0	....	94.2
36.0–40.0	1	2.9	97.1
41.0–45.0	0	....	97.1
46.0–50.0	1	2.9	100.0
Totals	35	100.0	....

Land Utilization and Size of Farms

The average farm selling produce in Baton Rouge in 1946 contained 45.5 acres, of which 22.2 were in cropland. Twelve acres of this cropland were in vegetables. Generally, the land planted to vegetables was used very intensively on these farms. In many cases two, and sometimes three, vegetable crops were harvested from the same plot of land during the year. By following this practice, the average grower was able to harvest 19.4 acres of vegetables from only 12.0 acres of land.

Most of the vegetable farms in the area are small, in terms of the number of acres of vegetables harvested for sale from each farm. Some of the crops grown, however, are very intensive, and a small acreage often represents an enterprise of efficient size. This is true especially of strawberries.

Nearly 60 per cent of the farms harvested less than 15 acres of vegetables in 1946 (Table IV). Four-fifths of the farms had less than 35 vegetable acres, and only seven had 40 or more acres for the year.

TABLE IV. VEGETABLE ACREAGE ON 35 FRUIT AND VEGETABLE FARMS SELLING PRODUCE IN BATON ROUGE IN 1946

VEGETABLE ACREAGE	Number of farms	Per cent of total	Cumulative total of percentages
Less than 5.0	6	17.1	17.1
5.0– 9.9	5	14.3	31.4
10.0–14.9	9	25.6	57.0
15.0–19.9	5	14.3	71.3
20.0–24.9	0	0	71.3
25.0–29.9	1	2.9	74.2
30.0–34.9	1	2.9	77.1
35.0–39.9	1	2.9	80.0
40.0 and over	7	20.0	100.0
Totals	35	100.0	......

Production and Sales

Thirty-three different types of fresh fruits and vegetables were produced by the 35 growers and sold in Baton Rouge in 1946 (Table V). More than 671 acres of land were used to grow this produce. This highly diversified production indicates the vegetable production potential of the area, and emphasizes the possibility of supplying the Baton Rouge market to a larger extent from local production.

The gross value of sales amounted to almost $105,000 for the year, or approximately $3,000 per farm. The farms averaged about 19 vegetable acres per farm.

TABLE V. Acreage, Yield per Acre, Production, and Value of Fruits and Vegetables Produced on 35 Farms Selling in Baton Rouge. 1946

Vegetable	Total acres	Production unit	Yield per acre*	Harvested production	Units sold	Average price	Value
Beets..................	5.0	Doz. bunches	261	1,306	1,294	$ .63	$ 813
Butterbeans............	10.2	Bushel	57	503	501	4.36	2,184
Broccoli...............	2.0	Doz. bunches	207	414	414	.87	360
Cabbage................	41.2	Pound	7,040	290,053	289,668	.023	6,693
Cantaloups.............	6.7	Dozen	32	214	214	.98	210
Carrots................	7.4	Doz. bunches	285	2,112	2,112	.65	1,369
Cauliflower............	1.0	Doz. heads	250	250	250	1.50	375
Collards...............	17.3	Doz. bunches	243	4,205	4,205	.69	2,920
Corn (green)...........	53.0	Doz. ears	224	11,872	11,872	.34	4,024
Cucumbers..............	6.5	Hamper	163	760	760	1.52	1,158
Egg plant..............	3.2	Hamper	136	435	435	1.51	659
English peas...........	7.2	Pound	861	6,200	6,200	.11	705
Field peas.............	32.2	Hamper	39	1,138	1,128	3.03	3,414
Figs...................	...	Bucket	...	60	60	1.00	60
Garlic.................	4.1	Pound	551	2,260	2,260	.30	678
Green peppers..........	4.5	Hamper	111	500	500	2.72	1,361
Irish potatoes.........	80.9	Cwt.	29	2,331	2,261	3.44	7,786
Italian beans..........	0.1	Bucket	150	15	15	.80	12
Lettuce................	2.1	Doz. heads	90	190	115	.94	108
Mustard................	129.3	Doz. bunches	354	45,179	45,155	.71	31,903
Okra...................	31.9	Hamper	72	2,308	2,308	2.53	5,850
Onions (dry)...........	3.2	Pound	2,469	7,900	7,900	.037	289
Onions (green).........	5.0	Doz. bunches	276	1,380	1,380	.60	827
Pears..................	...	Bushel	...	190	190	1.05	200
Radishes...............	3.1	Doz. bunches	250	775	775	.59	459
Shallots...............	11.4	Barrel	20	226	226	8.79	1,987
Sweet potatoes.........	58.6	Cwt.	51	1,438	1,248	3.69	4,607
Spinach................	10.0	Hamper	53	527	527	1.94	1,020
Snap beans.............	66.7	Hamper	60	2,610	2,610	2.72	7,101
Strawberries...........	10.3	Crate	125	800	800	4.48	3,587
Squash.................	8.0	Hamper	110	729	729	1.46	1,065
Tomatoes...............	13.0	Bushel	75	970	963	5.18	4,987
Turnips................	36.0	Doz. bunches	233	8,400	8,295	.70	5,828
Totals.........	671.1	....	.....	....	.....	....	$104,599

*Includes farmers' estimate of production not harvested.

Yield per acre for fruits and vegetables frequently is lower in the Baton Rouge area than in some of the production areas of other states. However, local growers still have a considerable advantage because of their proximity to Baton Rouge.

The five most important vegetables, on the basis of gross value of sales, produced by the 35 local growers and sold in Baton Rouge in 1946 were mustard, Irish potatoes, snap beans, cabbage, and okra. These five vegetables accounted for 57 per cent of the sales by the 35 growers.

Mustard was the most important vegetable on the basis of acreage harvested and gross value of sales. This crop accounted for about 19 per cent of the acreage and 30 per cent of the value of all fruits and vegetables sold in Baton Rouge in 1946 by the 35 growers.

Monthly Fruit and Vegetable Sales

The different kinds of fresh fruits and vegetables sold in Baton Rouge by local growers in 1946 ranged from 12 in March to 28 in June (Table VI). This means that Baton Rouge consumers were able to choose from a selection including a minimum of 12 fresh fruits and vegetables in any month during the year, and the choice became much wider in the peak months of local production. This indicates that the soil and climate in the Baton Rouge trade area are adapted to year-round fruit and vegetable production, and that the problems of local growers lie largely in the field of marketing rather than production.

The value of monthly sales of fruits and vegetables by local growers varies considerably during the year. In general, the marketing year may be divided into the spring-summer and fall-winter seasons. Volume of sales increases gradually from January to the peak of the spring-summer season in June. Sales are low in August, and increase until the peak of the fall-winter season is reached in November.

Some of the vegetables, such as snap beans, Irish potatoes, and cabbage, also have two distinct seasons each year. Spring beans begin in late April and are practically all gone before the end of June. The fall crop starts in September and ends in November. The spring Irish potato crop comes in during May and is disposed of largely by the end of June. The fall crop is dug usually in late October, and most of the crop is marketed before Christmas. The marketing season for early spring cabbage begins in late March and continues through June. The fall crop comes in October and lasts until the spring crop is ready for market.

Types of Buyers

Retail stores were the most important outlets for the 35 local vegetable growers who sold their produce in Baton Rouge in 1946. About 71 per cent of the value of all fruit and vegetable sales by the 35 local growers, or $74,120, was accounted for by sales to Baton Rouge retailers. Wholesalers bought about $24,000 worth of produce from these growers, which represented about 23 per cent of their sales.

Cafes, boarding houses, hotels, etc., purchased over $3,000 of fresh fruits and vegetables directly from local producers in 1946. In most cases, this trade was of a "regular customer" type, and had been built up over a period of years.

House-to-house retail sales by local producers were not practiced to any great extent in Baton Rouge in 1946. Although it would have been possible to realize somewhat higher returns by marketing house-to-house, most of the growers could not spare the time necessarily required for this method of marketing.

TABLE VI. Gross Value of Fruit and Vegetable Sales by 35 Farms in Baton Rouge in 1946

Fruit or Vegetable	MONTH												Total
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Beets	43	3	38	119	0	94	0	28	0	82	179	227	813
Butterbeans	0	0	0	0	22	1,177	907	78	0	0	0	0	2,184
Broccoli	28	0	0	87	0	0	0	0	0	0	68	177	360
Cabbage	1,191	403	165	310	354	158	0	0	0	387	1,758	1,967	6,693
Cantaloups	0	0	0	0	0	186	24	0	0	0	0	0	210
Carrots	193	65	65	73	246	149	26	0	6	75	193	278	1,369
Cauliflower	0	0	0	0	0	151	0	0	0	0	112	112	375
Collards	344	354	174	54	54	0	0	0	36	174	771	959	2,920
Corn (green)	0	0	0	0	137	1,321	2,342	224	0	0	0	0	4,024
Cucumbers	0	0	0	0	95	591	469	3	0	0	0	0	1,158
Egg plant	0	0	0	0	0	308	91	85	77	15	45	38	659
English peas	0	0	0	185	47	473	0	0	0	0	0	0	705
Field peas	0	0	0	0	227	1,441	1,011	372	242	121	0	0	3,414
Figs	0	0	0	0	20	40	0	0	0	0	0	0	60
Garlic	30	0	0	0	30	510	0	0	0	0	0	108	678
Green peppers	0	0	0	0	54	602	460	109	54	41	41	0	1,361
Irish potatoes	79	69	0	0	2,058	2,673	17	69	103	103	2,359	256	7,786
Italian beans	0	0	0	4	4	4	0	0	0	0	0	0	12
Lettuce	7	7	0	0	0	94	0	0	0	0	0	0	108
Mustard	1,402	2,422	3,441	3,952	3,057	2,603	1,650	1,160	3,650	3,757	2,358	2,451	31,903
Okra	0	0	0	0	52	1,399	1,497	1,191	1,009	542	160	0	5,850
Onions (dry)	0	0	0	18	18	39	0	0	0	37	69	108	289
Onions (green)	24	42	30	186	272	99	0	0	36	45	45	48	827
Pears	0	0	0	0	0	0	0	42	0	147	11	0	200
Radishes	18	53	154	113	15	6	0	0	3	6	35	56	459
Shallots	290	158	18	62	105	53	18	0	114	290	431	448	1,987
Sweet potatoes	251	162	111	111	0	0	369	739	277	724	1,531	332	4,607
Spinach	180	325	194	19	0	0	0	0	0	29	60	213	1,020
Snap beans	0	0	0	163	1,200	2,090	802	41	503	1,671	631	0	7,101
Strawberries	0	224	1,046	1,489	582	246	0	0	0	0	0	0	3,587
Squash	0	0	0	0	139	438	257	115	77	39	0	0	1,065
Tomatoes	0	0	0	0	254	2,661	995	269	295	316	197	0	4,987
Turnips	426	327	475	716	638	79	71	0	211	1,035	879	971	5,828
Totals	4,506	4,614	5,911	7,661	9,680	19,685	11,006	4,525	6,693	9,636	11,933	8,749	104,599

Farmers' Opinions on Present Marketing Facilities in Baton Rouge

The 35 local fruit and vegetable growers who sold their produce in Baton Rouge in 1946 were asked their opinions on the present marketing facilities in the city. Over 60 per cent were dissatisfied with existing marketing arrangements, and most of them thought that a produce market in Baton Rouge would do much to correct the unsatisfactory conditions. Every grower interviewed said there is a need for such a market, including those who are satisfied with the way they now operate. Growers believe that the most important functions a market in Baton Rouge could perform would be to stabilize prices and provide a cash outlet for a wider variety of fruits and vegetables.

Most growers were reasonably well pleased with the prices received for their produce in 1946, but a large proportion of them thought the retail mark-up on produce was too high in relation to prices received by growers.

SUMMARY

1. The rapid growth of Baton Rouge in recent years has not been accompanied by proportionate increases in many of the public facilities and services needed to serve the people adequately. Among those lagging behind are facilities for effectively marketing fresh fruits and vegetables. Baton Rouge has no organized produce market, although many cities of comparable size have produce marketing facilities.

2. Metropolitan Baton Rouge has a population of about 100,000 and is an important consumption center for fruits and vegetables. In 1946 the equivalent of 2,000 carloads of fresh produce was handled in the city, of which 1,660 carloads were consumed locally.

3. The parishes surrounding Baton Rouge comprise an important area of fruit and vegetable production. Nearly 34,000 acres were devoted to truck crops in the 9 parishes in the Baton Rouge trade area, with production valued at more than $3,000,000 in 1944.

4. Although Baton Rouge is an important consuming center and the local fruit and vegetable production is large, local growers provided less than 8 per cent of these commodities consumed in the city in 1946. These growers supplied the equivalent of only 125 carloads of produce valued at $185,000. Total consumption was 1,660 carloads valued at approximately $2,500,000. Most of the production from the trade area, consisting mainly of strawberries, snap beans, sweet potatoes, Irish potatoes, peppers, and shallots, is shipped through established marketing agencies to northern markets. Most growers contend that the lack of conveniently located marketing facilities prevents them from producing a greater variety of produce, and of doing more of their marketing in Baton Rouge.

5. In the survey only 35 growers were found in the trade area that sold a variety of produce in Baton Rouge in 1946. The 35 growers supplied about 60 per cent of the locally-grown produce sold in the city. Approximately 25 other growers of one or two crops, such as Irish potatoes, sweet potatoes, and strawberries, sold some of their produce in Baton Rouge during the season.

6. The average grower selling a variety of produce in Baton Rouge on a somewhat regular schedule in 1946 had a farm of 46 acres of which 22 acres were in crops. Twelve acres of this cropland were in fruits and vegetables, but by double and multiple cropping during the year 19.4 acres of fruits and vegetables were produced per farm. Sales amounted to approximately $3,000 per farm.

7. A wide variety of produce was grown in 1946 by local growers supplying the Baton Rouge market. At least 12 locally-grown fruits and vegetables were available each month, and in June 28 were available. Sales by growers, as well as the number of commodities in season, were lowest in late winter and highest in late spring and early summer.

8. Mustard, the most important vegetable grown by the 35 year-round producers serving Baton Rouge, made up 30 per cent of the total sales in 1946. Sweet potatoes, Irish potatoes, and strawberries were important during the months they were in season.

9. Retail stores were the most important outlet for the 35 growers, purchasing 71 per cent of their production. Wholesalers bought 23 per cent of the total.

10. Most growers were satisfied with prices received in 1946, but thought that marketing costs and margins between the producer and consumer were excessive in many cases. They think that a well-organized market, conveniently located, would tend to stabilize prices, stimulate fruit and vegetable production in the area, hold marketing costs to reasonable levels, and provide an opportunity to sell a much wider variety of produce.

11. Other benefits which would be expected from a wholesale produce market in Baton Rouge include considerable savings to growers in travel and labor within the city. In 1946, the 35 growers selling in Baton Rouge traveled nearly 35,000 miles in the city and spent 18,000 hours selling about $100,000 worth of produce. A market would save most of this travel and labor. It is also reasonable to expect that a market would result in a greater selection of produce available to buyers, plus freshness and higher quality in general.

12. Volume of produce handled in a market largely determines its success or failure. Year-round production of fruits and vegetables in the 9-parish trade area and consumption of fresh produce in Baton

Rouge are large enough to provide the volume necessary for a successful market. To take advantage of this potential volume of business and make the proposed produce market in Baton Rouge a success will require the establishment of adequate facilities for handling produce in a convenient location, the employment of capable management, sound financing, and the cooperation and support of growers, truckers, wholesalers, and retailers. If these requirements are met, it is reasonable to expect that a produce market in Baton Rouge would be of benefit to the entire community.

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INJURIES TO COTTON BY 2,4-D

By

CLAIR A. BROWN, Q. L. HOLDEMAN, AND E. S. HAGOOD

Warning

It has been estimated that about 2 million acres of crop lands were sprayed or dusted with 2,4-D and other herbicides in the United States and Canada during 1947. There is little doubt that these compounds will be used in greater quantities in the years to come. There is a definite place for these compounds in Louisiana.

This bulletin is written, not to discourage the use of 2,4-D, but rather to point out that if not properly applied, this and similar compounds may cause serious injuries to certain crops, and to recommend that all users obtain information on how, when, and where they can be used safely.

Information on these herbicides can be obtained by writing to, or calling at the office of, the Department of Botany, Bacteriology, and Plant Pathology, Louisiana State University.

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W. G. Taggart, *Director*

INJURIES TO COTTON BY 2,4-D

By

Clair A. Brown, Q. L. Holdeman, and E. S. Hagood

The new chemical 2, 4-dichlorophenoxyacetic acid, more commonly known as 2,4-D, is classed as a "selective" herbicide when used in extremely low dilutions. Either as a spray or as a dust, it will kill or injure many broadleaved plants without seriously injuring most members of the grass family. During the past couple of years it has been used extensively in various parts of the country in fields of cereals to destroy various weeds, in sugarcane fields to destroy the alligator weed, and in fields of rice to destroy such rapidly growing weeds as indigo and Mexican weed. It has also been used to clear the weeds from canals and drainage ditches and to eradicate water hyacinths in ponds, lakes, and bayous. In recent years, probably nothing has had a greater impact on agriculture than has the introduction of and use of 2,4-D and similar herbicides. In the future when more is known about these compounds and how and when they should be applied, they will be very widely used.

During the growing seasons of 1945 and 1946, tests with 2,4-D were made in South Louisiana in fields of sugarcane and rice and to a limited extent on other plants and crops. The results obtained were very promising. Similar results were also obtained in other parts of the country. Information regarding the preliminary tests became generally known and by the spring of 1947, in spite of warnings that there might be trouble on some plants, the stage was set for the wide use of 2,4-D. Warnings were issued in the following publications:

Brown, Clair A. Warning: Use 2,4-D compounds with care. Home Gardening for the South 6: 376-377, 380. June, 1946.

Brown, Clair A., and T. C. Ryker. The control of alligator weed in sugarcane and weeds in rice with 2,4-D. Down to Earth 2(4): 6-10. Feb., 1947.

Brown, Clair A., and Q. L. Holdeman. Controlling alligator weed in sugarcane with 2,4-D. La. Bulletin 410. January, 1947.

Ryker, T. C., and Clair A. Brown. The use of 2,4-D in rice fields for the control of weeds. Louisiana Bulletin 411. February, 1947.

That 2,4-D might cause injuries on such crops as cotton was indicated by the preliminary observations made in 1946. As an example, a cotton field near Baton Rouge was dusted with an insecticide that had been mixed in a machine in which 2,4-D had previously been mixed. Although the machine was cleaned as well as was thought necessary before mixing, enough 2,4-D was carried over to the insecticide to injure cotton rather severely. In this field, the yield of cotton was reduced about 60 per cent.

In 1947, 2,4-D was applied to bayous and lakes to kill water hyacinths, to sugarcane fields to kill alligator weed, and to rice fields to eradicate various weeds. It was applied in both spray and dust forms. It was applied by ground machines and by airplanes. The operators did not in all cases appreciate the dangers to adjoining fields and the result was that many fields of cotton and other crops received light applications of 2,4-D. The dust and even the spray, especially when there was a light breeze, drifted for considerable distances. Sometimes, airplanes made turns out over adjoining fields and even when the dust or spray was cut off, the air currents from the machines were sufficient to disperse the chemical. In some cases, the 2,4-D escaped from leaking hoppers.

Areas Studied

It was not long after the season opened in 1947 before reports of damage began to come in, especially from cotton growers. Injury to cotton in Louisiana by 2,4-D was reported from several parishes. Due to requests from the growers, a survey was made in certain areas and tests were made to answer certain questions regarding 2,4-D. The information obtained from the survey and the tests is given in this bulletin. The areas receiving the most attention are listed below.

Ouachita-Morehouse Area—During the early spring, 2,4-D dust was applied by airplane in Bayou Bartholomew and Black Lake Bayou near Monroe to eradicate water hyacinths.

Reports of damage to cotton and other crops began coming to the Experiment Station in early May. In this area, the airplanes were forced to fly rather high to miss the stumps and trees, and the dust drifted out over neighboring fields. It also appeared that airplanes in some places in making turns circled over the margins of cotton fields.

In this area, cotton plants were mostly small when the 2,4-D was applied. The reports as to damage were so numerous that two meetings were held for a discussion of the problems. A committee was appointed to determine the possible extent of the damage and to make recommendations to the farmers. This committee consisted of Mr. I. W. Carson, Extension Agronomist, Louisiana State University, Chairman; Dr. Clair A. Brown, Professor of Botany, Louisiana State University; and Dr. W. T. Penfound, Professor of Botany, Tulane University. This committee remained active during the season, and a study was made of this and other areas in the State.

Rice Area—In Southwestern Louisiana at different times during the growing season, rice fields were sprayed or dusted with 2,4-D.

Both ground machines and airplanes were used. In this area, cotton plants were in various stages of development. Some were blooming and producing squares and bolls when the rice was being treated.

Pine Prairie Area, Evangeline Parish—In Evangeline Parish, Miller's Lake, near Pine Prairie, was dusted with 2,4-D by airplane on June 18, 19, and 25 to eradicate the water hyacinths. As this area is well isolated from other areas in which 2,4-D was used, it was possible to obtain definite information on the distance of the drift of the dust. On the first day (June 18), the wind was blowing from SSE at a velocity of 10 miles per hour at take-off time, and the next day the wind shifted to ESE with a velocity of 7 miles per hour. There was little or no wind on June 25. The western and northern margins of the lake have a fringe of trees about two miles wide. Outside of this, the region is broken into small individual farm units which are a mixture of pasture, woodland, and fields of corn, cotton, and sweet potatoes.

Ferriday Area—Near Ferriday, cotton injury occurred in an area as much as 1,200 feet from a storage depot. Drums and sacks of 2,4-D were unloaded and reloaded at this depot as needed. Some of the packages were broken and the dust was apparently dispersed by the wind. Home gardens and sensitive ornamentals were injured.

Shreveport Area—Some injury to cotton was reported in the vicinity of Shreveport. From reports, apparently some 2,4-D had accidently become mixed with an insecticide which was used in dusting cotton. This case emphasized the necessity for careful handling of such toxic compounds.

Symptoms of 2,4-D Injuries

Cotton plants were injured by 2,4-D at practically any time during the growing season, from the seedling stage up until the bolls were well developed. All parts, including leaves and stems, flowers and young bolls, were injured. Injuries, however, mainly showed on the young developing parts. As the leaves and bolls approached maturity they seemed to be less sensitive. Young plants in the seedling or the preflower stage also recovered more rapidly than did those injured after flowering began. The following symptoms are based on observations made in the field during 1947.

Injuries to Leaves (Fig. 1)—Injuries mostly showed on the young developing leaves. Leaves fully formed at the time 2,4-D was applied rarely showed any characteristic or clear-cut symptoms though the normal green color often faded to a pale, yellowish-green. Leaves 2/3 to 3/4 normal size showed a general pallor and a slight clearing along the veins. The leaves developing from the unexpanded leaf buds were the ones which exhibited the conspicuous symptoms and it usually took from 10 to 14 days after dusting for the full development of

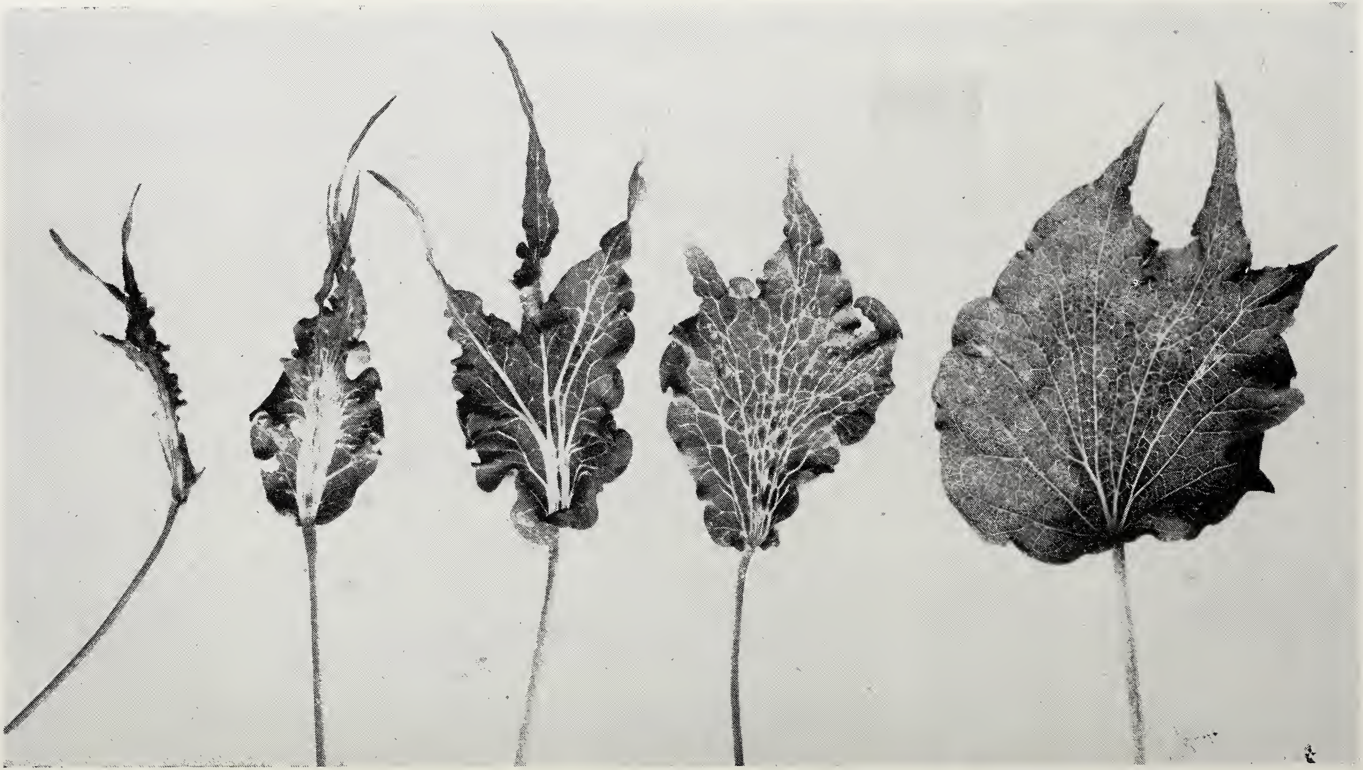

Fig. 1.—Characteristic leaf modifications caused by 2,4-D based on the categories used. First two leaves on the left are typical for *heavy* injury; middle pair, for *moderate* injury; and leaf on right, for *light* injury.

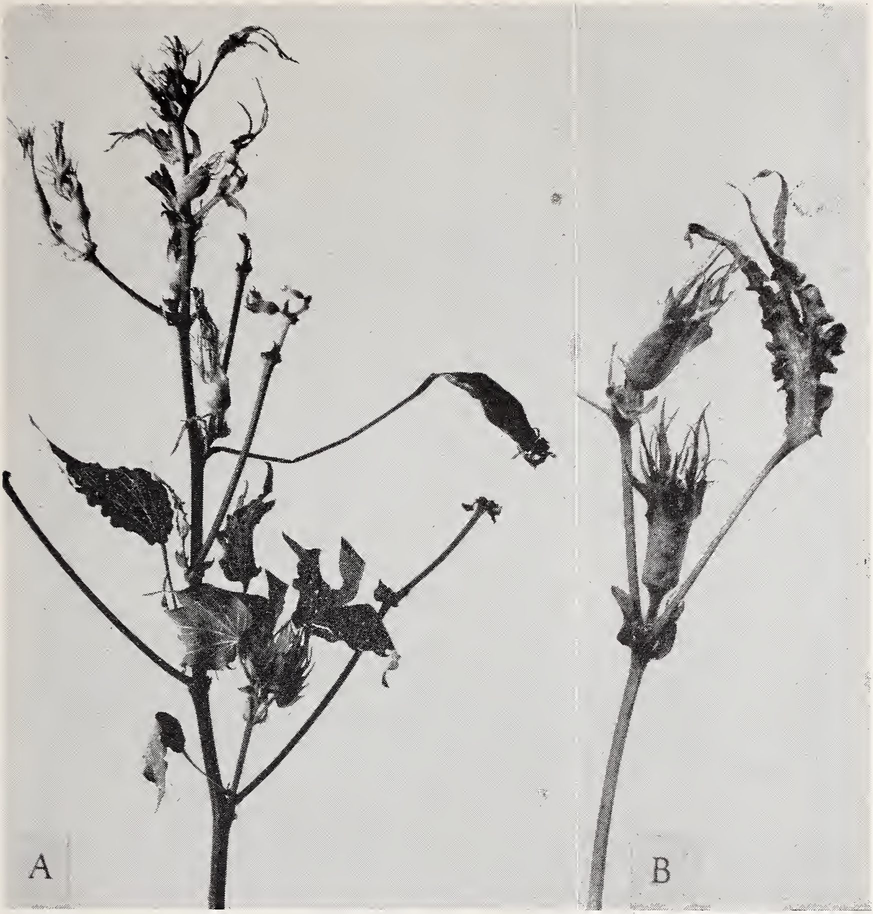

FIG. 2.—A. Top of cotton stalk showing cylindrical squares and abnormal leaves which developed after dusting. *B.* Close-up of cylindrical squares.

symptoms on these. The production of malformed leaves was usually confined to this period. Progressive changes in the degree of injury did not occur after this period except where the plants received a second or third application of 2,4-D.

Injuries to Flower Parts (Figs. 2 and 3)—The bracts surrounding the flower bud became veiny-mottled, with extra long tips to the fringing teeth. At times, the bracts were partially fused to each other. The greatest modification was the formation of cylindrical, fused bracts with attenuate lobes. The modification to the flower parts depended upon the time the plants received the 2,4-D and the quantity. Plants injured in the pre-square stage formed squares which showed only a mottled, veiny appearance, with longer lobes and a partial fusion of the bracts but without other changes in the general shape of the square. When the injury was somewhat later, the greatest modification to the square was the change to a cylindrical shape and a complete fusion of the bracts (Fig. 2B). The injured squares were also smaller than the normal ones.

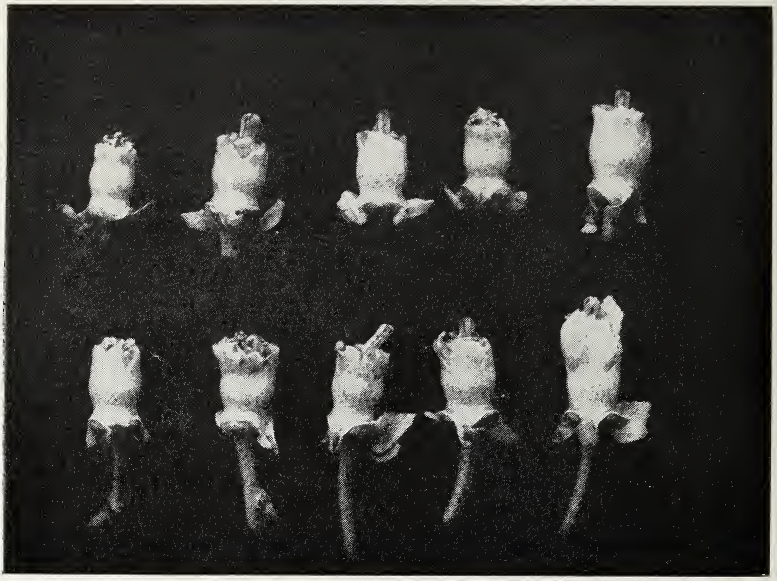

Fig. 3.—Modifications of the flower bud by 2,4-D.

When 2,4-D was applied in the pre-bloom stage or later, large quantities of the squares turned yellow and dropped off. Prior to falling, the flower buds started to grow. The growth of the perianth was retarded and the stamens and pistils pushed out of the apex of the bud (Fig. 3). The flowers were also modified, but most of the modifications observed were on plants which had partially recovered from an earlier application of 2,4-D. The petals were dwarfed, sometimes strap-shaped to filiform, and in many cases were fused to form a united corolla. Flowers which developed after the plants recovered were mostly normal.

Bolls which developed from the cylindrical-shaped squares were frequently abnormal. Usually they were elongated with a slightly hooked apex. At times, one or more locks did not develop seeds.

Injuries to Stems (Fig. 4)—In some instances the lower part of the stem of the cotton plant at the ground level was distinctly swollen. This type of injury was observed in a field adjacent to a dusted rice field. It is possible that these plants received more 2,4-D than other plants exhibiting similar leaf symptoms but lacking the swollen stems.

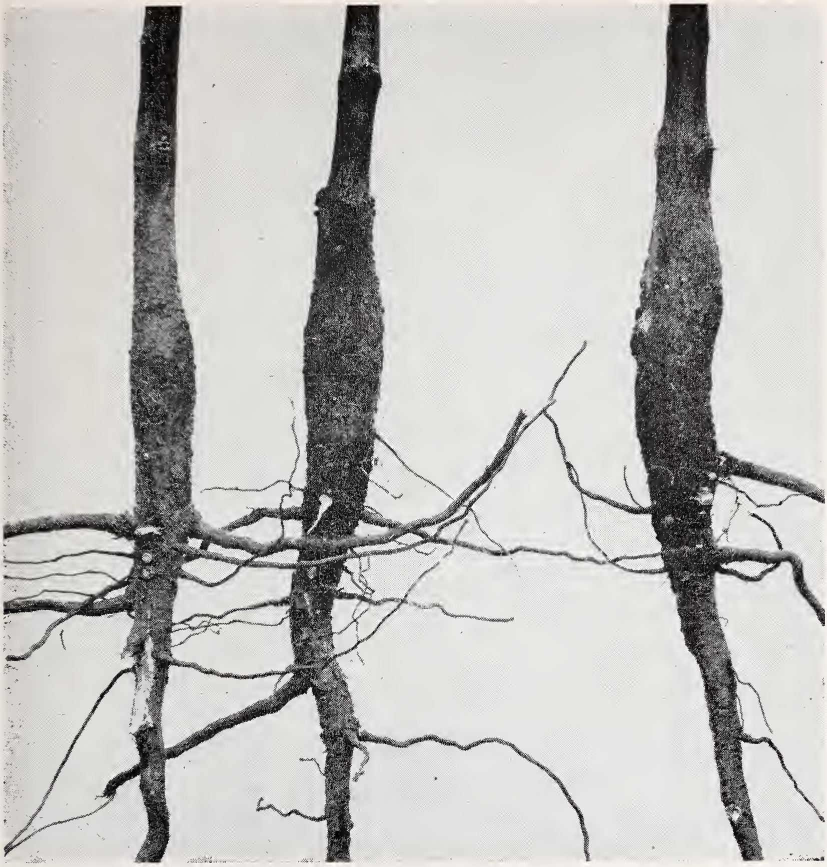

FIG. 4.—Swellings of the stems of cotton plants which were injured with 2,4-D.

Classifying Injuries On Cotton

In the survey, it became necessary to group the fields in several categories, representing degrees of injury to the plants. The survey was started during the early part of the season when the plants were young, and consequently most attention was paid to injuries to seedlings and to young leaves. For the most part, the degree of injury was determined merely by the symptoms actually observed in the field. In the survey, it was not possible to judge the amount of 2,4-D which the plants received by the injuries which were observed. The categories as used in the survey are listed below (Fig. 1).

Dead and Dying—The terminal bud became black, shriveled, and was easily detached. The cotyledons drooped and became pale, gray-green in color. The hypocotyls were either swollen excessively and cracked, or shriveled and nearly dry. Plants thus affected were seedlings 3-6 inches tall, before the first typical leaf had expanded. In many plants, the apex of the stem elongated for 2-3 inches and produced miniature scale-like leaves. Such plants sometimes died. Diagnosis of injury was very difficult on seedlings of this size, being complicated by a heavy infestation of aphids and thrips and by an infection of sore shin on the roots, a disease caused by *Rhizoctonia* sp., which seemed to have been intensified by planting of cotton on a recently buried legume crop.

Heavy—The leaves were dwarfed, frequently curved, elongated, usually less than 3/4 of an inch wide. The main veins were distinctly parallel, close together, conspicuous, with white to yellow areas around them; the margins were narrow and wavy. The lateral lobes pointed forward with long attenuate apices. Usually the leaves were thickened and crisp.

Moderate—The leaves were elongated, with a trend toward expansion near the tips. The veins were conspicuous, with cleared areas around them, frequently divergent, but connected with a conspicuous network. The margins were more ruffled than in the above category, and the sides usually drooped. The apices of the lobes were long attenuate.

Light—The leaves showed a reduction in size and were frequently irregular in shape, but lacked most of the symptoms of the above classes. The margins were slightly wavy. The lobes were longer and sharper pointed than normal, but not as long as the more severely injured leaves. The network of small veins was conspicuous. The surfaces were glabrous in contrast to the normal leaves with fine pubescence.

Trace—This category was used for leaves which were nearly normal, with a slight pebbling of the surface, as well as for the condition in which a field showed only an occasional plant with marked symptoms while the rest of the plants were normal in appearance.

Extent of Injuries

In Ouachita and Morehouse parishes some 10,500 pounds of 15 per cent dust were applied by plane. Injury was found on 1748 acres of cotton, classified as follows: *dead and dying*, 297 acres; *heavy*, 471 acres; *moderate*, 404 acres; *light*, 256 acres; *trace*, 320 acres; and no injury on an additional 1,806 acres surveyed. A survey in the Pine Prairie area of Evangeline Parish showed injury on 86 farms and the degree of injury was classified as follows: *heavy*, 192 acres; *moderate*, 62 acres; *light*, 74 acres; and *trace*, 117 acres.

Drift

That fine dust particles can be carried for long distances by air currents is recognized. In this country in recent years, dust has been carried in dust storms originating in the semi-arid plains region for a thousand miles or more. Dust from volcanoes is known to have encircled the earth.

It is not surprising then that insecticidal, fungicidal, or herbicidal dusts when applied by airplane or even by ground machines will be dispersed to a certain extent to adjoining areas by air currents before settling to the ground. This is usually spoken of as drift. Drift has caused some concern in the past with certain insecticidal dusts containing arsenic. Drift did not, however, receive serious consideration until 2,4-D herbicides began to be widely used. With these, serious losses have resulted from the drift of the dust.

In Louisiana, the drift of 2,4-D dust was early recognized as a very important factor in the weed control work and in 1947 considerable attention was paid to it.

Drift in the Bayou Bartholomew and Black Lake Bayou areas was mostly confined to 1¼ miles from the zone of application. That the injury was confined to this distance is remarkable in view of the height the pilot had to fly to keep clear of the snags in the bayou. Some injuries occurred along the flyway from the loading depot to the bayous, which was possibly due either to leaking hoppers or to the blowing off of spilled dust on the outside of the plane or the possible cleaning of the hopper by the pilot. Pilots have been observed to clean out their hoppers while in flight. Injuries to cotton were greater in the areas where the airplanes turned around or changed their courses than in those affected by the general drift. Bayou Bartholomew is so serpentine that the pilot could not fly the area treated in one continuous trip. Instead, he flew short segments, which necessitated turning around over adjoining fields. The suction of the plane apparently pulled considerable quantities of 2,4-D along after the pilot had shut off the hopper.

At Miller's Lake, symptoms of heavy injury were found for about 2 to 3½ miles from the lake, light symptoms at 5 miles, and trace injuries at 8 miles. These distances were ascertained from measurements on aerial photographs and maps.

Drift may occur with ground machines and even hand dusters as well as with airplanes, though the distance is usually much less. In one area, slight damage was noticed at a distance of nearly a mile following the application of 2,4-D with a hand duster.

Drift also occurred with sprays, although the distance was usually much less when compared with dusts. In one instance, a liquid spray was applied in diesel oil at the rate of 2 gallons per acre by airplane with a 10-12 mile wind. A trace of injury was noticed at a distance of 1,800 feet in an area of non-sensitive crops. In another instance, weeds showed 2,4-D symptoms about 1,200 feet from a rice field which was sprayed with a water-ester emulsion at 2 gallons per acre. In Tennessee, TVA research workers found that a finely atomized spray injured cotton at a distance of 2½ miles.

This emphasizes the care with which 2,4-D compounds must be handled. Until some way is found to reduce the drift, either by larger particle size of the dust or by a heavier diluent, it is unwise to use 2,4-D dusts in areas of mixed agriculture. Liquid sprays will be found much safer. However, it must be remembered that the liquid sprays will also drift to some extent and unless the proper precautions are taken, losses with these may occur.

Recovery

One of the interesting observations made in 1947 was that cotton plants may recover after receiving an application of 2,4-D. It took from 3 to 6 weeks for plants showing heavy injuries to recover. Seedlings made a quicker recovery than older plants, and plants showing moderate injury likewise made a quicker recovery than those showing more severe injury. In instances where the growth of the main stalk was permanently arrested, axillary buds produced branches which grew to about normal height (Fig. 5). These side shoots showed no 2,4-D symptoms and produced normal flowers and fruits. If the normal branches were started at the time of dusting, then 2,4-D injury appeared on the new growth, but as the branches elongated, normal foliage was again produced. The temporary cessation of growth, however, is an important factor which must not be overlooked. Usually the boll weevil infestation builds up by the middle of July so that there is very little chance of producing cotton from the late-set bolls. The delay of 3 to 6 weeks put some of the cotton fields into the period of maximum injury by the boll weevil. Fields which, on the basis of estimates, had the capacity to produce 260 to 360 pounds of lint per acre did not produce this quantity because many of the top bolls had weevils in them. Under such conditions additional poisonings were necessary for best production.

Effect on Yields

Information on the effect of 2,4-D on yield of cotton is very important. Such information, however, has been difficult to obtain. All that it has been possible to do has been to estimate the apparent injury in the field, watch the recovery, and then check the actual yield against yields of other years and other fields and against estimates of expected yields. It is important to consider the effect of time of application of 2,4-D, whether in the seedling stage or in the flowering stage, and also to have some idea of the effect of different amounts of 2,4-D.

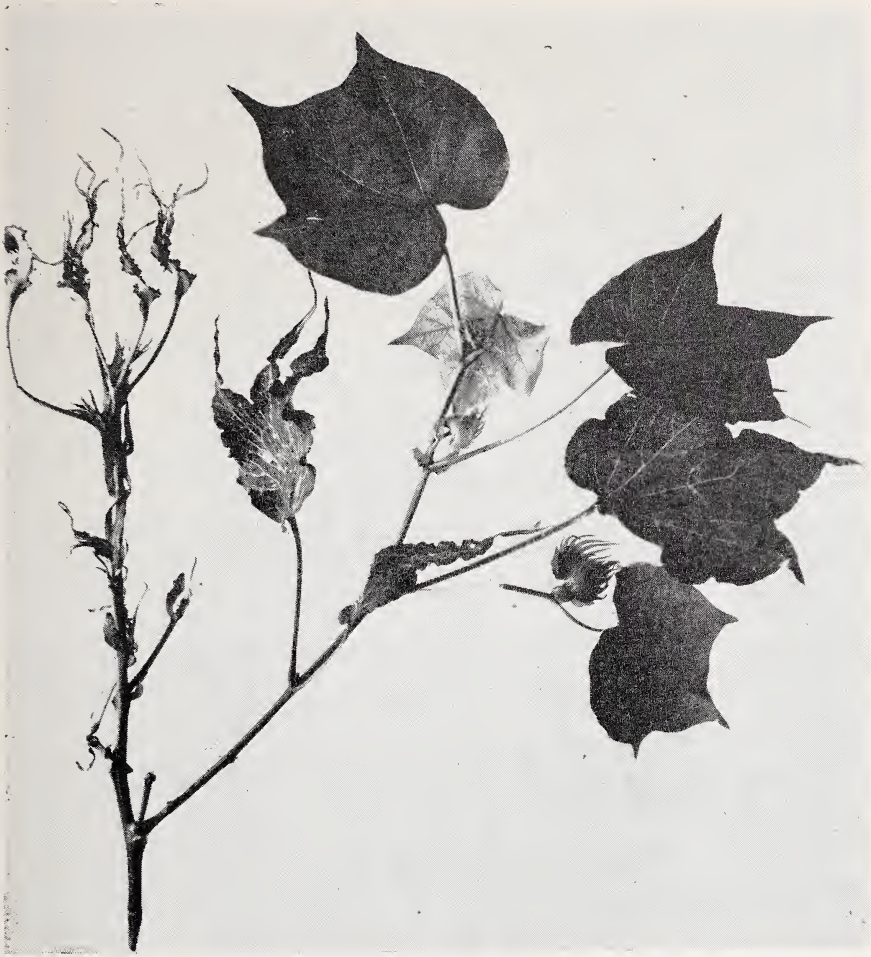

Fig. 5.—Recovery of cotton by the development of branches from the lower part of the stem. Growth of the main axis was stopped and this portion frequently died.

Yields are affected not only by the actual injury to the plants but also by the length of the recovery period. If the growth is checked for 2 to 3 weeks, boll formation may be delayed and consequently there may be more loss due to the boll weevil.

In estimating losses in yield, it is necessary also to consider other factors which may have affected yield, such as aphid and thrips infestations, root rot and sore shin troubles, rainfall, fertilization, cultivation, and numerous other factors that may influence the growth and production of the bolls. Also, the past season was very favorable for the production of cotton and this may have helped to minimize the actual losses.

In estimating the losses it has been possible to compare yields in the different fields with those of previous years. Records on yields of previous years are on file in the Louisiana State Office of the Production and Marketing Administration, Louisiana State University, Baton Rouge, Louisiana. Of course, yields in some years are better than those of other years and this has to be taken into consideration.

In general, yield losses have been greater on cotton injured late in the season when the plants were in bloom than on young cotton.

The following information on the conditions in different parishes is presented merely to give some general idea of the effect of 2,4-D. No attempt is being made to evaluate losses in any particular field.

Ouachita and Morehouse Parishes—About the middle of September certain fields in the area which had been surveyed in the spring were examined and the yields estimated by counting the number of bolls per 100 feet of row and computing the yield per acre. Estimates made in this way were slightly lower than the actual yields obtained at time of picking and ginning.

When the committee recommended plowing up the injured cotton in certain fields, the farmers were requested to leave a few rows so the development of the plants could be followed. Estimated yields on some of these check rows are as follows: 370, 370, 363, 239, 142 pounds of lint per acre respectively. The first three are within the range of the normal yields for these farms but under the yields of uninjured cotton in nearby fields. The last two were not representative yields as these checks were on poor sites and did not receive normal cultivation.

Cotton which was plowed up and replanted to cotton by May 24 produced good yields. The production of one specific field was estimated at 568 pounds of lint per acre and the owner reported 625 pounds.

Estimates made in September of three fields which in the spring showed heavy injury were 478, 414, 393 pounds of lint to the acre. These figures are within the ranges of yields according to the past histories of the respective farms. The actual yield reported by the farmer for the first field was 630 pounds of lint. No attempts were made to estimate losses in these fields.

Fields showing moderate, light and trace injuries made such good recovery that no estimates were made in these categories.

Fields which were dusted before the cotton plants emerged from the soil showed no reduction in yield. The estimate for one field indicated a yield of 631 pounds of lint. The owner reported better than a bale to the acre and was well satisfied that he sustained no injury.

St. Landry Parish—Several communities in this parish suffered injury to cotton and other crops from drift of 2,4-D dust. One of these fields was dusted the last of May or during the first week of June when the plants were just starting to bloom. The plants exhibited heavy injury symptoms and shed many unopened squares. This field produced 198 pounds of lint to the acre, whereas it has a maximum crop history of 649 pounds of lint to the acre. Another farm which had cotton in a field adjoining a rice field produced 74 pounds of lint to the acre. This field had always produced a poor crop, as its maximum recorded yield was 162 pounds of lint. It would seem that losses as high as 50 to 60 per cent occurred in fields which received a heavy application of 2,4-D when the plants were in bloom.

Vermilion Parish—One field in this parish was examined June 20. At that time it showed moderate to heavy injury. The plants were about 30 inches tall and had many blossoms and squares which showed injury. It was dusted about May 5-7. The farmer picked an average of 435 pounds of lint cotton per acre from 10.7 acres and the normal yield on the farm is 375 pounds.

Evangeline Parish—The Pine Prairie community near Miller's Lake received 2,4-D dust on June 18, 19, and 25, when the lake was dusted for control of water hyacinths. The cotton was 24 to 30 inches tall with squares, blossoms, and bolls present. From 1 to 3 bolls per plant were set at the time of the dusting. Fields which received sufficient quantity of the dust to produce heavy injury to the foliage shed all of the unopened squares in a short time. This region was visited again on August 4. At that time the plants were starting to recover, as judged by the production of normal flowers and a few normal leaves. Yield figures are not available for these fields. However, the lateness of injury and the length of time necessary for recovery indicate prospects of a decreased yield in the fields which showed severe injury.

Experimental Studies

Many questions in regard to the action of 2,4-D need answering. Some of the most urgent ones have received some attention.

Minimum Quantities of 2,4-D Producing Injury—Field observations showed that 2,4-D dust drifted for a distance of 8 miles and produced slight abnormalities. It seemed important to know the minimum quantity of 2,4-D that would produce injuries. Staten[1] has reported injuries with 0.1 cc of a 1000 parts per million (ppm) solution and no injuries at concentrations between 0.0001 and 0.1 ppm. At Baton Rouge, 0.1 cc of 0.01, 0.1, 0.5, 1, 10, 25, 50 ppm solutions of 2,4-D acid were applied to the cotyledons of cotton seedlings while the first two leaves were in bud (Fig. 6B). The first symptom was a drooping of the cotyledons in about 24 hours, from which there was a recovery in

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[1] Staten, Glen. "Contamination of Cotton Fields by 2,4-D or Hormone-type Weed Spray." Jour. Am. Soc. Agr. 38: 536-544. 1946.

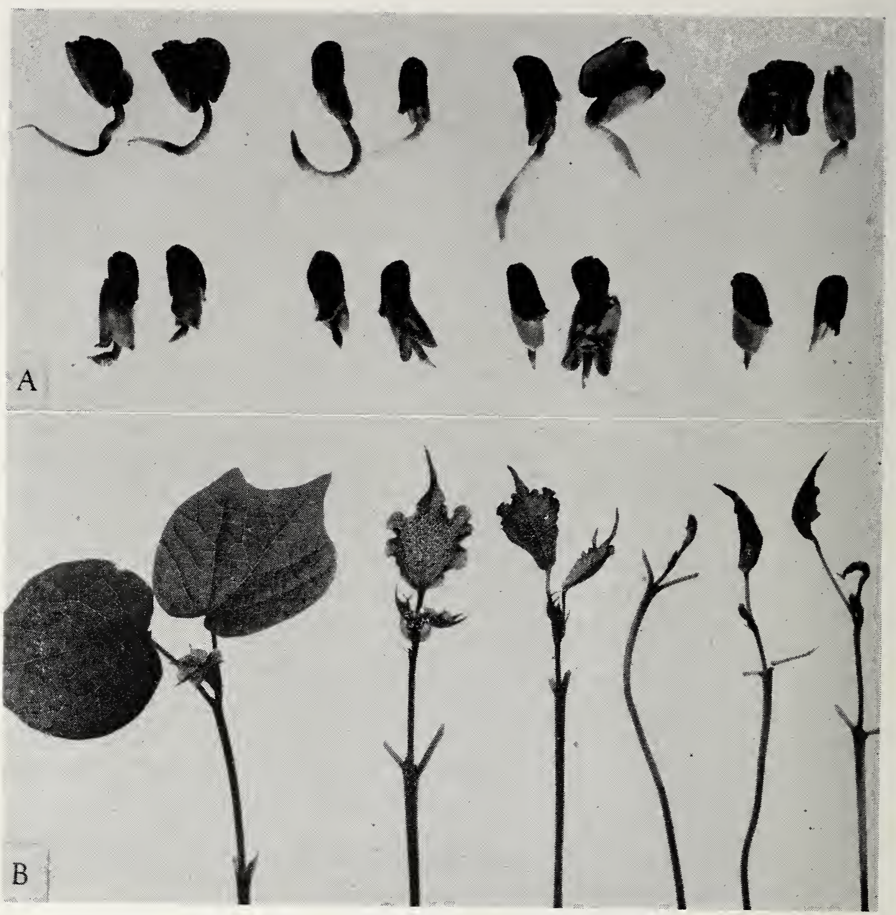

FIG. 6.—*A*. Response of germinating seeds in solutions with different amounts of 2,4-D. Left to right, top row: control, 0.1, 0.5, 1 ppm; bottom row: 5, 10, 25, 50 ppm. *B*. Response of cotton seedlings to known amounts of 2,4-D. One-tenth of a cubic centimeter of a 2,4-D solution was applied to the cotyledon in concentrations of 0.5, 1, 10, 25, 50 ppm and compared with control receiving none (left). Treated Nov. 20. Photo Dec. 4.

the next 2 to 3 days. At concentrations of 50, 25, and 10 ppm the first two leaves became dwarfed, curled, and malformed. The succeeding 6 to 8 leaves were similar and the plants did not recover in a period of 8 weeks. At 1 ppm the first 4 to 5 leaves were injured, and recovery started at the end of 5 weeks. The quantity of 2,4-D used at the 1 ppm level was 0.0001 milligram of acid per plant. Light but unmistakable injury showed at the 0.5 ppm level, or 0.00005 milligram. At this concentration only 2 to 3 leaves showed injury before the normal leaves were produced in about 4 weeks after treatment. These minimum amounts indicate the sensitivity of cotton seedlings and emphasize the value of sensitive plants in the detection of 2,4-D by a bio-assay.

The application of 1 cc of a 50 ppm solution to the soil around the cotton seedlings resulted in less injury than the application of 0.1 cc of a 1 ppm solution to the cotyledons.

2,4-D was applied to the soil in a set of flats at the rate of 1, 0.1, 0.01 pounds of free acid per acre. In the 1-pound treatment, only 2 seedlings emerged, one of which subsequently died. At the lower levels a good germination was obtained, although the emergence of the seedlings was slower than in the controls.

Cotton seeds were germinated in petri dishes containing 5 cc of 0.01, 0.1, 0.5, 1, 5, 10, 25, 50 ppm solutions (Fig. 6A). The lowest concentration producing a reaction was at the 0.1 ppm level. At this concentration, there was a slight stunting of the root tip. At the 0.5 ppm level, the growth of the root tip was arrested and there was a noticeable swelling in the transition zone between the hypocotyl and the root tip. At 1 ppm, the swelling was very evident and the hypocotyl was definitely shortened in length. Seeds of other plants exhibiting this degree of injury never recovered when transferred to soil. Cotton seeds barely germinated at the 5, 10, 25, 50 ppm levels and the hypocotyls and root tips were markedly dwarfed.

Ten pounds of 15 per cent dust per acre was the quantity used to kill water hyacinths, this being equal to 1.5 pounds of the free acid per acre. This quantity was also toxic to cotton seedlings. This is the equivalent of 0.0156 grams of acid per square foot. One pound of the 15 per cent dust per acre (or 0.15 lb. of acid) did not kill cotton seedlings, but produced severe leaf injury. Thus the amount necessary to kill cotton seedlings is between 1 and 0.15 pounds of acid per acre. The exact minimum killing quantity has not been determined but it will vary with the size of the plants, rapidity of growth, and method of application. Three grams of a 15 per cent dust, about a teaspoonful, when liberated in a slight wind, produced injury on about one-half acre of cotton.

Leaching of 2,4-D from Soil—A 2,4-D dust was applied to a series of flats at the rate of 1, 0.1, 0.01 pounds of acid per acre. One set of flats received water at the rate of 1 inch of rain per acre and another set at the rate of 2 inches of rain. These flats were planted to cotton. When one inch of rain was used, malformed leaves developed on the cotton in the flats which were treated at the 1 pound of 2,4-D acid per acre level, whereas at the lower levels the cotton produced normal leaves. After the equivalent of 2 inches of rain the cotton grew normally. This indicated that 2,4-D will either leach from the soil or become inactive in a wet soil. Several investigators have reported that spray strength solutions of 2,4-D in moist soil have become non-toxic in a period of 4 to 7 weeks.

Seed Transmission—The question has been asked whether cotton seed from 2,4-D injured plants can be stored and then used for planting purposes. Pridham[1] reported that young bean plants from seed harvested from plants sprayed while the pods were green showed malformations characteristic of those produced by 2,4-D. In view of the sensitivity of cotton and the fear by farmers that they should not save their seed, the possibility of seed transmission of 2,4-D was studied. Cotton seeds were collected from plants in two fields which were dusted early in May and which later showed heavy injury. Collections of seeds were also made from two fields which were dusted in June just after the plants started to bloom. There was a 60 per cent reduction in yield of lint cotton from the latter two fields. These seed lots and also seed from non-injured plants were planted in sterilized soil in the greenhouse. The first three true leaves of all seedlings were normal in appearance. This seems to indicate that 2,4-D was not stored in these seeds in sufficient quantity to produce abnormal seedlings.

These preliminary tests, however, are not sufficient to answer the question, especially since 2,4-D symptoms have recently been reported from Texas on seedlings from seed harvested from 2,4-D injured fields.

Discussion

The various 2,4-D compounds have proved to be very effective weed killers and therefore their use has become a standard agricultural practice for the production of certain crops. Their widespread use and popularity arose through their relatively low cost per acre in comparison with standard herbicides. The intensive investigations for the past three years have been centered on their ability to kill undesirable or unwanted plants. At first, very little attention was paid to their stimulatory possibilities or to their disadvantages. As investigations with 2,4-D progressed certain disadvantages were found and recorded in the literature. Certain crop plants were found to be very sensitive to 2,4-D.

Unfortunately, until very recently very few have realized the potency of the 2,4-D compounds. At times, these products have been handled carelessly and have been applied in a haphazard manner without due consideration of the possible effects upon adjoining crops. Also, these products have come into general usages rapidly and before the necessary information concerning them has been obtained by research. In other words, the commercial use has out-distanced the research. In some cases, the information has come the hard way, by experience. In the future these herbicides will be used in much greater quantities than at present, and ways to eliminate the dangers will be found. Users of 2,4-D, however, should recognize the dangers involved, and should use all precautions to minimize injuries on sensitive crops.

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[1] Pridham, A. M. S. "Effect of 2,4-D on bean progeny seedlings." Science 105: 412. 1947.

Summary

During 1947 the various 2,4-D compounds were used as herbicides in Louisiana. They were used principally in rice and sugarcane fields to control various broadleaved weeds and in ponds, canals, and bayous to eradicate the water hyacinth. They were used both as dusts and sprays and were applied by airplanes, ground machines and by hand dusters and sprayers.

In some cases the 2,4-D drifted out over adjoining fields and settled on sensitive crops. Drift occurred with both dusts and sprays but was more pronounced with the dusts.

While a number of cultivated plants were injured by the 2,4-D, most of the reports of damage were in fields of cotton.

The extent of injury to cotton was associated with the age of the plants. Losses were less on plants which received the 2,4-D while in a young stage than on plants in the flowering stage.

Cotton seedlings between 4 and 6 inches tall produced abnormal foliage in the period immediately following the application of 2,4-D. Even those plants which showed severe leaf symptoms eventually recovered and later produced bolls in a normal manner.

Seedlings which showed only moderate to light leaf symptoms developed into normal plants.

Plants injured severely during the flowering period in most cases showed decreases in yield.

In limited tests, seedlings raised from seed from injured plants developed normally.

2,4-D falling on the soil is leached out or rendered inactive by water. Normal cotton was raised on soil which had received a small amount of 2,4-D.

One serious aspect of the 2,4-D problem is that the herbicide checks the growth of the cotton plants for 3 to 6 weeks during the period of recovery. This may place the plants in the period of maximum boll weevil injury and be responsible for reduced yields.

TECHNOLOGY AND SCIENCE ROOM

Louisiana Bulletin No. 427 March 1948

WEED CONTROL IN RICE WITH 2,4-D

By T. C. Ryker

CAUTION

Care should be used in handling and applying 2,4-D. It should not be applied even as a spray when it is windy or there is a breeze blowing in the direction of a neighboring field where sensitive crops such as COTTON, SWEET POTATOES and the COMMON VEGETABLES are being grown. Cotton is particularly sensitive to 2,4-D. When only 2 to 5 gallons of spray per acre are applied by airplane there is still danger of injury from the spray drifting for quite long distances. Drift is more likely to occur with the esters of 2,4-D than with the sodium or amine salts. Based on feeding tests, there is no evidence that 2,4-D is poisonous to man or livestock.

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W. G. TAGGART, Director

WEED CONTROL IN RICE WITH 2,4-D

T. C. Ryker[1]

Weeds in rice fields cost growers hundreds of thousands of dollars each year. The extent of these losses is not always realized by the growers. They result from lower yields in fields where rice competes with weeds, from the labor costs involved in hand pulling such weeds as indigo and red rice, and from the lower value of rice that contains weed seeds. In the last few years, because of the scarcity of labor, many farmers have not been able to remove such weeds as indigo and red rice from their fields, and this has resulted in a marked increase of these weeds.

In the control of weeds in rice fields, three problems are involved: (1) the control of red rice, (2) the control of such grasses as barnyard grass **(Echinochloa spp.)**, and (3) the control of such broadleaf weeds as indigo, curly indigo, Mexican weed, alligator weed, red weed, etc. This last group has received considerable attention in the last two years because of the discovery that 2,4-D will kill certain of them without seriously injuring rice.

That 2,4-D might be useful in controlling certain weeds in rice fields was indicated in preliminary tests made by the Plant Pathology Department of the Louisiana Agricultural Experiment Station in 1945. Results were so promising that in 1946 a large number of tests were made by this Department throughout the rice area. The results of these tests with certain recommendations and warnings were published in Louisiana Agricultural Experiment Station Bulletin No. 411.

Similar tests with 2,4-D were made in various other states, and there was increased interest in chemical weed control.

Due to this general interest in weed control and also to the great need of controlling rice weeds in some way, the use of 2,4-D in rice fields increased rapidly. As a matter of fact the commercial use of 2,4-D moved ahead faster than was justified by the information which was available. Approximately 3,000 acres were treated in Louisiana in 1946 and over 40,000 acres in 1947. These commercial applications, while they controlled weeds satisfactorily, in some cases caused injuries to rice from the use of too much 2,4-D, and in other cases caused injury to cotton and other crops in nearby fields because of the drift of the dust.

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[1] Formerly associate pathologist, Louisiana Agricultural Experiment Station, now with E. I. DuPont de Nemours & Co., Inc., cooperating with the Louisiana Agricultural Experiment Station.

Tests were made in 1947 to find the answer to such questions as the relative efficiency of the different types of 2,4-D, the amount per acre to use, the effect of 2,4-D on rice of different ages, and the best means of applying the chemical.

The purpose of this bulletin is to bring together the information accumulated in 1946 and 1947, and to make tentative recommendations for the use of 2,4-D in rice fields for the immediate future. It may be assumed that these recommendations may be changed somewhat as more information regarding 2,4-D and other herbicides becomes available.

The Chemical 2,4-D

The chemical 2,4-D is an acid that is relatively insoluble in water. The marketable forms, however, are soluble and are of three general types: a dry salt such as the sodium salt, an amine salt such as the liquid triethanol amine salt, and esters such as the ethyl, butyl and isopropyl esters. Each has certain properties that should be understood for its proper use.

The commercial sodium salt dissolves easily in water. It is a dry powder containing from 60 to 85 per cent 2,4-D. Five gallons or more of water are necessary to dissolve enough of the sodium salt to treat an acre. The amine salt of 2,4-D is a concentrated liquid and only 2 to 3 gallons of water are needed to dissolve the proper amount to treat an acre. This material is slightly more expensive than the sodium salt. The esters of 2,4-D are materials that can be used either with water or oil. They usually penetrate the tissues of a treated plant more quickly than the sodium or the amine salts and do not wash off as easily if a rain follows treatment. They are considerably more expensive and have a further disadvantage that they are more volatile and danger from drift is greater.

The part of these chemicals which is active in killing weeds is supposed to be the 2,4-D acid. When the amount per acre to be used is calculated with a commercial product, the percentage of acid equivalent must be known. This is given on the label. In this bulletin where amounts of 2,4-D per acre are given they refer to the pure acid. This is necessary since the commercial products differ in the amount of 2,4-D in them.

To make it easy to know how much of a commercial product to use, Table 1 has been prepared. This table gives the amount of a commercial product per acre needed at rates of ¾ to 1½ lbs. of 2,4-D acid per acre. For example, if the acid equivalent of the product to be used is 70 per cent and the rate of application per acre is 1 lb., the table shows that 1 lb. 7 oz. of the material should be used for each acre to be treated.

Table 1. Amount of chemical needed per acre with acid equivalent of 2,4-D from 25 to 85 per cent.

Acid Equivalent of 2,4-D Material to be Used	Amount of Chemical to Be Used Per Acre at Rates of							
	3/4 lb. Acre		1 lb. Acre		1 1/4 lbs. Acre		1 1/2 lbs. Acre	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
25	3	0	4	0	5	0	6	0
30	2	8	3	5	4	3	5	0
35	2	2	2	14	3	9	4	4
40	1	14	2	8	3	2	3	12
45	1	11	2	4	2	12	3	5
50	1	8	2	0	2	8	3	0
55	1	6	1	13	2	4	2	12
60	1	4	1	11	2	1	2	8
65	1	2	1	9	1	15	2	5
70	1	1	1	7	1	13	2	2
75	1	0	1	5	1	11	2	0
80	0	15	1	4	1	9	1	14
85	0	14	1	3	1	8	1	12

Effect of 2,4-D on Rice

Rice varies in its reaction to 2,4-D, depending both on the age of the plants and the amount of 2,4-D used. When rice seeds are just beginning to germinate they are very sensitive to 2,4-D and even a very small amount of the chemical will kill the small seedlings. As the seedlings become older they become less sensitive so that when they are three to four weeks old, which is usually by the time the rice fields are flooded, it is relatively safe to use ¾ of a lb. of 2,4-D per acre. At this age rice plants are usually only slightly injured. They turn a darker green than untreated ones and there is a slowing down in the rate of growth for two to three weeks. If a treated plant is pulled up and examined, its base is often seen to be slightly swollen and the development of new roots is slow and the old roots are often decayed. By the third week after treatment, new roots are present and the plants are growing normally. If more than ¾ of a lb. to the acre of 2,4-D is applied at the time the rice is three to four weeks old, there is often severe injury and the plants may die. Injury seems to be greater when plants have been growing under dry conditions than when they have come up with plenty of soil moisture present and the soil is moist or wet at the time of treatment.

After the plants have reached five weeks or more in age, and they have been flooded, there is much less danger of injury and 2,4-D has been used at rates of 1¼ to 1½ pounds per acre with little or no injury. While the plants may turn a darker green, there is not the stunting that occurs when 2,4-D is used on younger plants.

When rice plants are heading it is dangerous to use 2,4-D. At that time the 2,4-D may blast the flowers and many of them will not develop into rice grains.

Time of Treatment and Amount of 2,4-D Per Acre

In tests made in 1946 and 1947, the best results in the control of Mexican weed **(Caperonia castaneaefolia)** were obtained when the 2,4-D was applied before flooding. When flooded immediately after treatment, control was less efficient than when the flooding was done 3 to 6 days later. On the other hand when the flooding was delayed for a longer period, new weed seedlings came up and these not having been treated with the 2,4-D lived and grew rapidly. As rice plants in this period are sensitive to 2,4-D, not more than ¾ lb. per acre should be used.

Treatment the second and third week after flooding was also effective with Mexican weed where ¾ to 1 lb. of 2,4-D per acre was used. As Mexican weed plants gradually become more resistant to 2,4-D as they grow older, for later treatments it was found advisable to increase the amount of 2,4-D used to 1¼ to 1½ lbs. per acre. Even this rate of application was not always effective.

The indigo plant **(Sesbania macrocarpa)** was very susceptible at any age. Three-fourths of a pound of 2,4-D to the acre killed indigo even as late as flowering time. Where this weed is the only one to be controlled, the only precaution necessary is to see that the 2,4-D reaches the plants.

Curly indigo **(Aeschynomene virginica)** appeared more resistant to 2,4-D than either Mexican weed or indigo. The experiments indicated the best control was obtained when the curly indigo plants had grown out of the water but were not too large when treated. This was about the second and third week after flooding. One pound of 2,4-D per acre was necessary. However, good control of curly indigo was often secured when the chemical was applied as late as 6 weeks after flooding where 1½ lbs. of 2,4-D per acre were used.

Red weed **(Melochia corchorifolia)** in rice fields is confined for the most part to the levees. It is easily killed and should be treated as soon as all plants have come up. This is usually two to three weeks after flooding. The treatment of the levees at this time will also control any Mexican weed that is present.

Many other weeds were controlled in rice fields and canals with the amounts of 2,4-D per acre given above. Among these are alligator weed **(Alternanthera philoxeroides)**, bladder pod or old fashion coffee bean (**Glottidium vesicarium**), mule ear (**Heteranthera limosa**), Sagittaria (**Sagittaria** sp.), sedges such as yellow sedge (**Cyperus iria**), wild onion (**Cyperus articulatus**), tadpole sedge (**Rhynchospora corniculata**), Fimbristylis (**Fimbristylis miliacea**), toothcup or red stem (**Ammania coccinea**), turtle back or batwing (**Commelina** spp.), water hyacinth (**Piaropus crassipes**), and water primrose (**Jussiaea** sp.). One of the weeds which is not killed by 2,4-D is gooseweed (**Sphenoclea zeylanica**).

How to Apply 2,4-D

In the weed investigations, 2,4-D has been applied both as a dust and as a spray. The use of the dust is not at present considered to be safe in areas where sensitive crops are being grown, since the dust drifts for rather long distances, particularly when applied with an airplane. Air currents and wind are known to carry dusts as much as three miles from treated fields.

In the early tests where 100 gallons of the 2,4-D solution were applied per acre as a spray, the dusts gave better control in some cases than sprays. However, with some of the newer equipment it is possible to apply as little as 2 or 3 gallons of the solution per acre and still obtain a satisfactory spread of the 2,4-D over a field. Tests have indicated that about 10 gallons of water to the acre will give good spread over a field and not result in too much drift if it is not put out while there is a wind.

In general, the most economical means of treating large areas is by airplane. Airplanes equipped to spray are now available. The cost of treating an acre is about $2.50 to $3.50 including the 2,4-D.

Ground equipment is also being developed for use in spraying. A ground machine usually consists of a tank mounted on a tractor or cart with a small gasoline motor, a pump and a spray boom and nozzles. The spray boom is the most critical part of the equipment, since proper spacing and correct size of the nozzles are necessary. The nozzles should be so spaced on the boom that the spray from each nozzle will overlap that of the next one. There are two main types of nozzles on the market which are known as the cone type and fan type. The fan type has given better results although it has the disadvantage of clogging more easily. Good strainers are necessary to remove dirt and trash.

A small 3-gallon compressed air sprayer can be used for treating small areas. It can be equipped with a small boom 14 inches to 28 inches long and two or three nozzles. If spray concentrates are used at the rate of 10 gallons per acre, one man can spray as much as ½ acre an hour.

Among the leading manufacturers of nozzles are the Spraying Systems Co., 4021 West Lake St., Chicago 24, Illinois, and the Monarch Mfg. Co., 2501 E. Ontario St., Philadelphia, Pa. Nozzles, as well as information on the size and types to use, may be obtained direct from them if not available at local distributors.

Rice Canals

There are many weeds growing in irrigation canals and on canal banks which can be controlled with 2,4-D. Among these, alligator weed presents a serious problem, as it clogs the canals and also spreads into fields irrigated from these canals. While alligator weed is susceptible to 2,4-D, it has not been successfully controlled when growing in water, since it is only killed back to the water. However, when applied 15-30 days before the canals have been flooded, 2,4-D at the rate of 1½ to 2 lbs. to the acre has given good control of alligator weed.

Problems in Rice Weed Control

While 2,4-D has proved to be a very valuable agricultural tool in the control of certain rice weeds, much more information is needed in regard to its use. It has been observed that rice does not always act the same when treated with 2,4-D. Occasionally, severe injury has occurred in a field of rice while other fields treated in a similar way have shown no injury. Also, in some cases a satisfactory control of the weeds has not been secured. A great deal of information is needed on the effect of environment on the susceptibility of the rice plants and of the various weeds to 2,4-D. Answers to many such questions are needed as quickly as possible.

Recommendations

The following recommendations for the use of 2,4-D in rice fields are tentative. They are made rigid in order to reduce as far as possible injuries to rice and other crops.

1. Dusting of rice with 2,4-D cannot be recommended at present because of the drift to fields where sensitive crops are growing. All of the following recommendations apply only to spray applications.

2. The best time to treat rice fields for the control of Mexican weed and curly indigo is during the second and third week after flooding. At this time, use 1 pound (acid equivalent basis) of 2,4-D per acre. At this time, there is little danger that the rice

will be injured. Since 2,4-D must be applied to the weeds to obtain a satisfactory kill, the water in the field must not be so deep that the weeds are covered.

3. If the treatment is later than the second or third week after flooding, 1¼ to 1½ pounds of 2,4-D (acid equivalent) per acre should be used for the control of Mexican weed and curly indigo. If only indigo (and not curly indigo) is present, 1 pound of 2,4-D (acid equivalent) per acre is sufficient.

4. If ground machines are used, the fields must be treated prior to flooding. Not more than ¾ pound of 2,4-D (acid equivalent) per acre should be applied. The use of more than this amount may injure the young rice seedlings. It is best to delay treating the rice before flooding as long as possible, since the older the rice plants are, the less likely they are to be injured. The field should not be flooded before the third day after treatment nor later than the sixth day after treatment, in order to obtain the best kill of weeds.

5. In order to control the alligator weed in irrigation canals, 1½ to 2 pounds of 2,4-D (acid equivalent) per acre should be applied to the canals 15 to 30 days before the water is pumped into them.

Louisiana Bulletin No. 428

May 1948
(Revised June 1953)

THE PARASITES AND PARASITIC DISEASES OF CATTLE

By
Roy L. Mayhew

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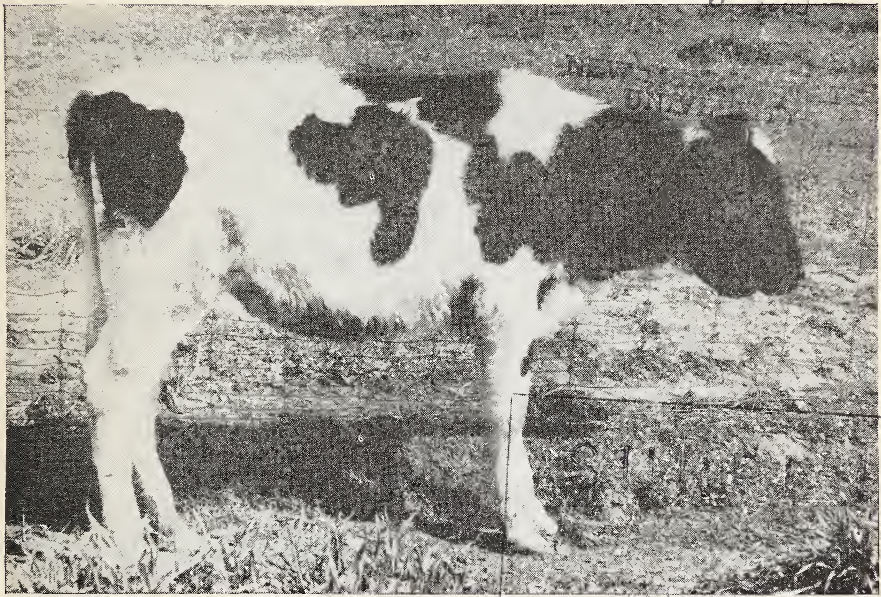

Calf showing advanced stages of chronic parasitism. Note the rough coat and the general depressed condition. The swelling under the jaw, so evident in this animal, develops in some cases only.

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CATTLE FOR PARASITES OR PROFITS?

Losses from parasites of the digestive organs, liver flukes, lungworms, and coccidia cost the livestock owner a very large sum of money annually in deaths, loss of flesh, stunted growth, extra care, etc.

It is fundamental in the problem of control of parasites to keep in mind that there is a part of the life of the parasites inside and a part outside of the cow or calf. The part inside consists of larval development and the adult. The larvae, for which at present there is no treatment, cause the acute symptoms and the most serious damage. The acute stage of the infection passes into the chronic with the maturing of the larvae into adults. The adults of some species can be effectively removed by the appropriate treatment.

Prevention of losses from parasitism is a problem of proper herd management based on the life cycles of the species involved. The following practices will serve to keep parasitic infections at a low level:

1. *Sanitation* in all its phases, especially the weekly or frequent removal of manure from barns, sheds, and shade areas, is a most important step.
2. *Good drainage* in pastures and lots leads to the destruction of the larval stages of all parasites. Dryness is especially important in the barn sanitation program.
3. *Treatment* of animals at regular intervals two or three times a year eliminates the adults and hence reduces the number of larvae that may produce new infections.
4. *Pasture rotation,* practiced where and as often as possible, will aid in the reduction of infections.
5. *Feeding of phenothiazine* in the grain ration at the rate of 1½ grams per day is effective in reducing the number of larvae of the hookworm, nodular worm, and stomach worm about the premises, thus reducing the infections in the next generation of animals.

Consult a veterinarian in regard to a parasite control program for your farm.

The expenses of good management practices will be offset in the raising of more and healthier animals that produce more meat and milk.

TABLE OF CONTENTS

Page

Introduction 5

The Rumen Fluke 8

Parasites of the Fourth Stomach 9

  The Large Stomach Worm 9

  Small Thread-Like Stomach Worms 11

Parasites of the Small Intestine 12

  The Hookworm 12

  The Cooperias 14

  The Ascarid 15

  Thread-Necked Worms 15

  Strongyloides Sp. 16

Roundworms of the Abdominal Cavity 16

Parasites of the Large Intestine 17

  The Nodular Worm 17

  The Whipworm 19

Tapeworms 20

  Adult Forms 20

  Larval Forms 22

Lungworms 23

Liver Flukes 26

  Common Liver Flukes 26

  The Lancet Fluke 31

  Fascioloides Magna 31

Coccidia and Coccidiosis 32

Johne's Disease 36

Prevention 36

  Management Practices 36

  Low Level Feeding of Phenothiazine 41

Treatment 42

  Phenothiazine 43

  Copper Sulphate and Copper Sulphate-Nicotine Sulphate 45

THE PARASITES AND PARASITIC DISEASES OF CATTLE

ROY L. MAYHEW[1]

INTRODUCTION

Cattle, as are all of our domestic animals, are affected by numerous species of internal and external parasites. Among the internal parasites, twenty-six species of roundworms are reported as occurring in the digestive organs, four species of flukes, five species of adult and larval tapeworms, twenty-four species of protozoa, and an additional miscellaneous group of seven species including the lungworm and abdominal worm. Many of these species do not have a wide distribution or cause serious damage and therefore are not included in the following pages. Of the external parasites at least twenty-seven species of ticks, lice, mites, and flies have been reported as infesting cattle. Since the external parasites are on the outside surfaces of the animals their presence is easily detected and methods for their control are fairly easily and safely carried out. The methods for their control and eradication are also more generally known than for the internal parasites. It is for these reasons that a discussion of external parasites is not included in this bulletin, but an effort has been made to include information regarding all species of internal parasites that cause disturbances of digestion and the accompanying disorders. Thus anaplasmosis, thought by many workers to be a protozoan parasite, has not been referred to because, insofar as is known, it is a blood disease and the symptoms, course of the disease, and diagnosis have no similarities to parasitism and the two would, therefore, not be confused. Brief mention is made of Johne's disease because it can be, and sometimes is, confused with parasitism.

The symptoms produced by the various species of parasites of cattle have many similarities and may be divided into acute and chronic stages.

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[1] The author wishes to express his appreciation to the many persons who have assisted in the accumulation of the information this bulletin contains. Particular thanks are due Doctors Groth, Porter, and Davis of the Regional Animal Disease Research Laboratory at Auburn, Alabama, for reading the section on coccidiosis; Dr. O. Wilford Olsen of the U. S. Department of Animal Industry for much assistance in writing the section on liver flukes; and Dr. H. J. Bennett of the Louisiana State University Department of Zoology for reading the section on the rumen fluke. Appreciation is due Doctors Oglesby, Piercy, Cox, Gray, Goff, and McCleskey and the late Mr. W. T. Cobb of the Louisiana State University College of Agriculture staff for reading the manuscript and making numerous suggestions as to content and expression. Thanks are due Miss Lorraine Boss for making the drawings and Dr. E. C. Tims for making the photograph of the worm specimens. Thanks are also due Dr. H. B. Elliot of the Louisiana State Livestock Sanitary Board Diagnostic Laboratory for reading the manuscript of the revised edition and to Dr. Wendell Krull for reading the section on the lancet fluke.

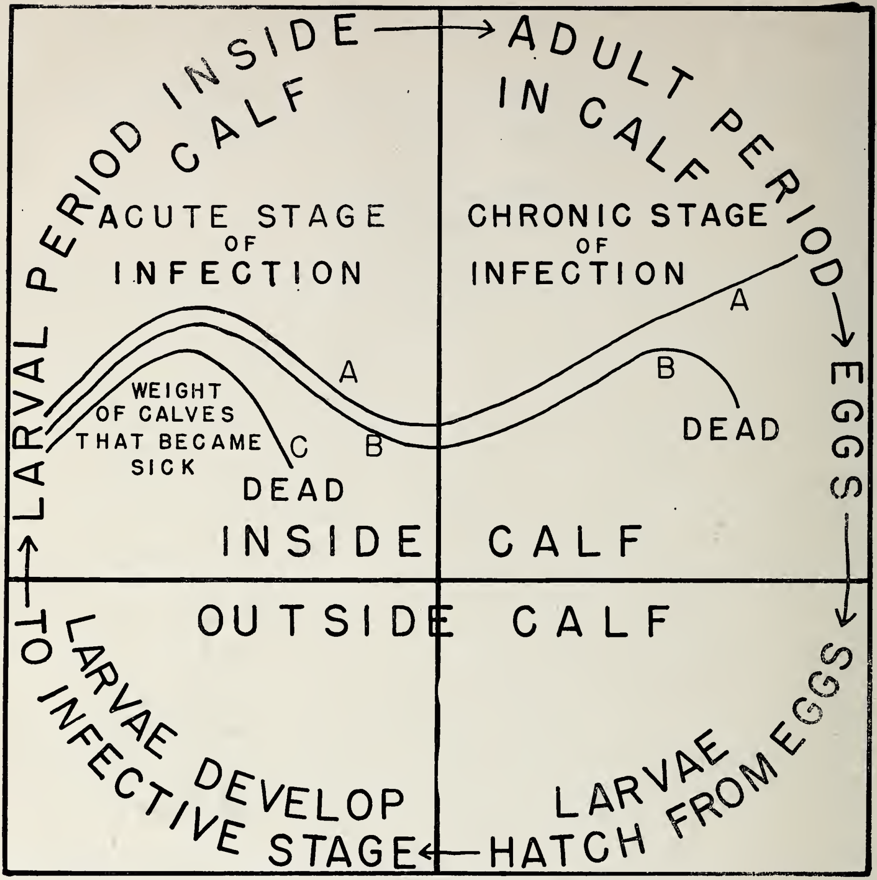
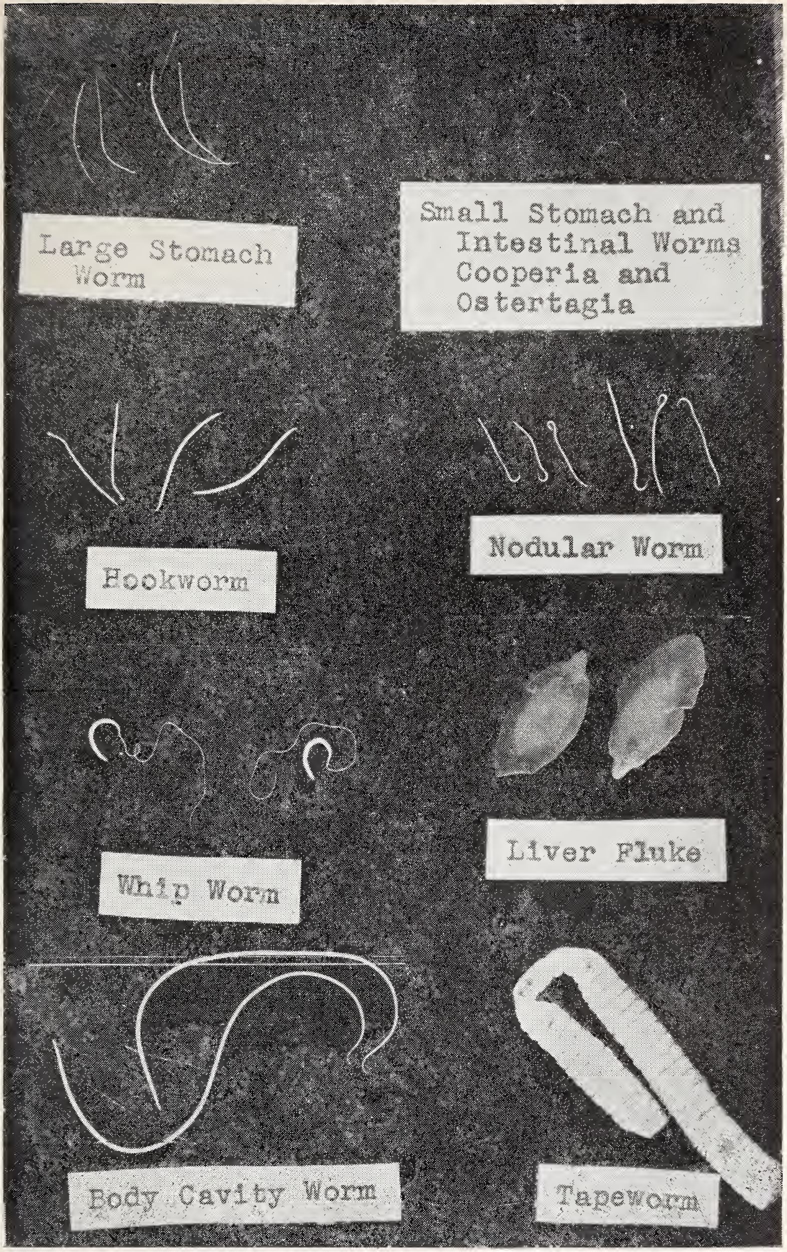

LARVAL PERIOD INSIDE CALF
ADULT IN CALF PERIOD
ACUTE STAGE OF INFECTION
CHRONIC STAGE OF INFECTION
WEIGHT OF CALVES THAT BECAME SICK
A
B
C
DEAD
A
B
DEAD
EGGS
INSIDE CALF
OUTSIDE CALF
TO LARVAE DEVELOP INFECTIVE STAGE
LARVAE HATCH FROM EGGS

Diagram showing the relationship of the periods of the life of parasites to the effects on calves.

A diagram based on the results of experiments at the Louisiana Experiment Station showing the relationship of the periods in the life of parasites to the effects on calves is shown above. In the upper portion of this diagram are indicated the events that take place inside the calf or cow, and in the lower portion those that occur outside. It is necessary for all of these steps to take place and they must occur in this order. There is no intermediate host necessary in the case of the roundworm parasites of cattle such as occurs in the case of the flukes. Neither is there any multiplication of the parasites within the calf or cow as is the case in the bacterial diseases. As a result of this the severity of the disease is dependent upon the number of infective larvae gaining access to the susceptible animal. The larvae that hatch from the eggs that are laid in the manure by the adult worms develop to the infective stage and gain entrance to the digestive system through the mouth and/or skin, depending on the species. In



Photograph of the most common parasites of cattle, actual size.

the digestive system they undergo a series of changes in the progress of which they become adult worms. Experiments have shown that very severe symptoms are produced by these larvae during this time due to their penetrating the intestinal wall and otherwise causing a general interruption of the normal digestive process. The diarrhea, loss in weight, and lack of appetite which constitute the acute symptoms of the disease develop during this period and are much more severe than any damage that has been observed during the period of the adult worms. The symptoms observed during the adult period are a continuation of those started during the larval period and, therefore, this is called the chronic stage of the infection.

An attempt is made to show diagramatically the weights of animals that become sick. Line A shows the course of the gain or loss in weight of an animal that survived the disease. His weight and general condition remain below normal for a long period, but in the course of months or a year or more, he gradually recovers from the damage caused by the larvae. Line B represents the weight gains of an animal that makes considerable gain during the chronic stage but when unfavorable conditions come along is not able to muster enough reserve strength to survive. Such an animal has a good appetite and improves more or less in weight and general condition, but when the pasture becomes short and unfavorable winter weather comes along, he gets down and sooner or later death results. (See picture on front cover.) Line C represents the weight gains of an animal that becomes very severely affected, loses weight rapidly, and dies during the acute stage of the disease.

The economic losses from parasites may be said to be due to deaths resulting from severe infection and from loss in weight and the general condition of recovered animals. There is also the extra expense of special care, feed, and treatment of those animals showing symptoms. There is no way of determining the total economic loss from parasitic diseases of cattle of all ages, but it is certainly a large sum.

THE RUMEN FLUKE

One fluke (*Cotylophorum cotylophorum*) is found in the rumen or paunch and in small numbers in the reticulum or honeycomb (second stomach) of cattle. These parasites are small worms somewhat conical in shape and convex on the top or dorsal side. They are about one-fourth inch in length and reddish in color when alive.

Life Cycle—The life cycle is similar to that of other species of flukes in that a snail is required as an intermediate host. The eggs are passed in the manure, and small larvae hatch from the eggs in from 11 to 29 days depending upon the temperature. The snail (*Fossaria parva*) rarely exceeds one-fourth of an inch in length and is commonly found along the margin of open ponds and streams where moisture and decaying vegetation are present and where there is no shade. The larval forms that hatch from the eggs are called miracidia. They enter the body of the snail and there develop through a succession of stages into the infective stage. The time required for development within the snail varies from 30 to 91 days according to the temperature. These larvae encyst on grass in the pasture and thus are taken into the digestive organs of cattle during grazing. They first pass to the duodenum or front portion of the small intestine where they remain from three to five weeks. From the duodenum they migrate forward to the rumen where they complete their development. The time required for the development of the larvae to adult worms in the calf is about four months. The total time required for the life cycle is from five to eight months, depending upon the temperature.

Symptoms—In heavy infections in South Africa it is said that severe inflammation is produced by the young stages in the duodenum which results in diarrhea. The adults are not believed to cause any damage. In the United States, losses from this parasite have not been reported.

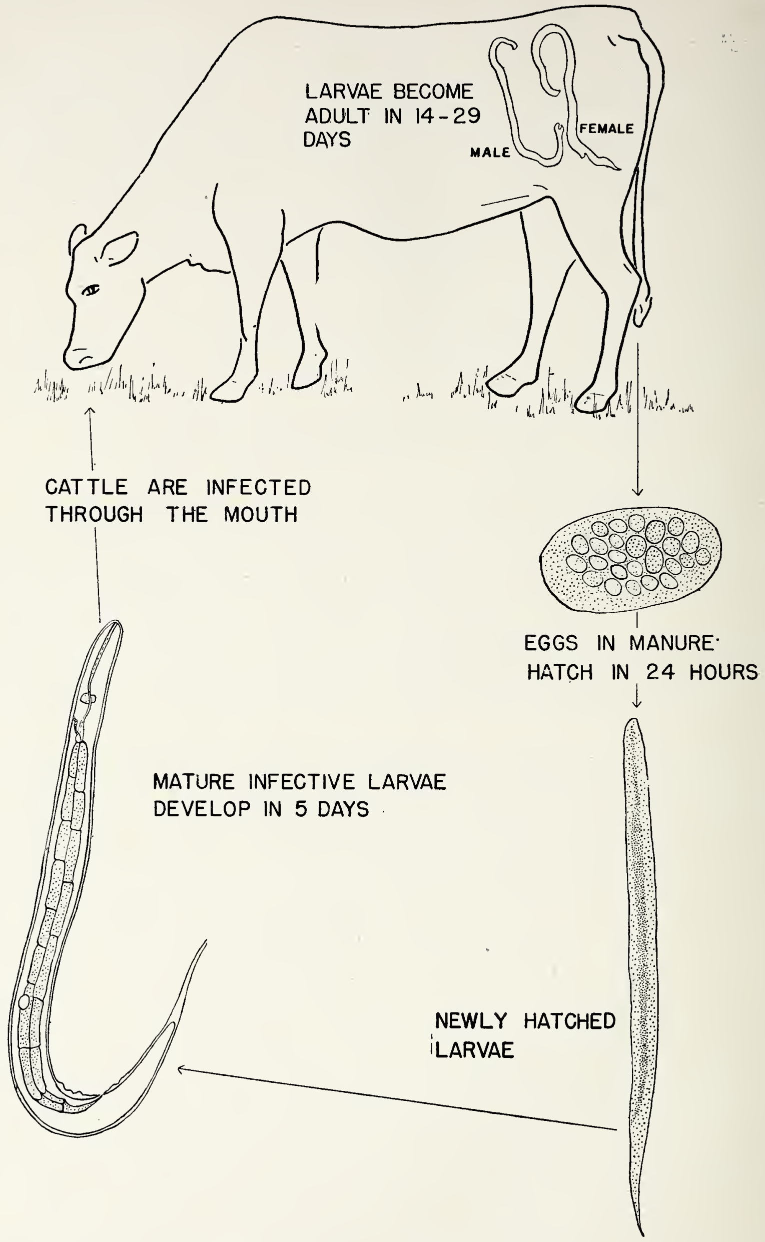
PARASITES OF THE FOURTH STOMACH

The Large Stomach Worm

The large stomach worm (*Haemonchus contortus*) is often present in large numbers along the walls and folds of the fourth stomach or abomasum of cattle, sheep, and goats. These parasites are ¾ to 1½ inches in length, of sufficient diameter to be easily seen, and, particularly the larger specimens, are marked with a spiral red stripe which has led to their sometimes being called the twisted wire worm. The photograph on Page 7 shows this species in relation to the other important parasites of cattle.

Life Cycle—The eggs are deposited by the adult females in the contents of the fourth stomach of the calf and pass out in the manure. Small larvae hatch from these eggs in from 18 to 24 hours. A diagram showing the stages in the life cycle is shown on Page 10. The newly hatched larvae require about five days in which to develop so they can produce infection in another calf. This stage is recognized under the microscope by the presence of a thin, transparent outer covering or sheath which offers some protection against being killed by drying out or too low or too high temperatures. Infection is by way of the mouth and, upon reaching the fourth stomach, the larvae complete their development into adults in from two to four weeks, most of them requiring about four weeks. That the adults will live and produce eggs for as long as 14 months in calves under conditions in which reinfection does not take place has been shown in our experiments. The length of life of the larvae under the various soil, weather, and grass conditions is not known but probably varies greatly under the different combinations of conditions in the pasture.

Symptoms—Calves have been found to gain little or lose weight, and a more or less severe anemia develops during the larval period. The adults are bloodsuckers having mouth parts for piercing the tissues and in this manner they no doubt contribute to the unthrifty condition of infected animals.


LARVAE BECOME ADULT IN 14-29 DAYS
MALE
FEMALE
CATTLE ARE INFECTED THROUGH THE MOUTH
EGGS IN MANURE HATCH IN 24 HOURS
MATURE INFECTIVE LARVAE DEVELOP IN 5 DAYS
NEWLY HATCHED LARVAE

LIFE CYCLE OF STOMACH WORM

Immunity—Experiments at the Louisiana Agricultural Experiment Station have shown that an immunity or resistance to infection with the large stomach worm is developed by inoculation with pure cultures of the infective larvae. Infection takes place as a result of the first inoculations, then with additional or sometimes without additional inoculations the number of adult worms that have become established is suddenly reduced sharply and abruptly as indicated by the number of eggs recovered from the manure. Subsequent inoculations failed to establish any large number of adults or produce any symptoms of parasitic infection. Attempts to establish this immunity previous to the initial inoculations by the injection of extracts of adult worms or powdered whole worms have thus far failed to produce any protection from infection. Apparently this immunity is permanent when it is once established, because when some of these animals were placed in a heavily contaminated pasture the infection remained at a very low level as evidenced by the number of eggs recovered from the manure and by the general physical condition of the animals. It was possible to follow some of these animals until they were six years old. Poor feeding during the winter months had no influence on the immunity, since there was no increase in the level of the infection. Neither was it possible to break down the immunity by lowering the plane of nutrition to a very low level by a ration of only cottonseed hulls. Animals fed cottonseed hulls until they showed definite emaciation, even almost to the point of death, did not become reinfected when reinoculated.

Treatment—The copper sulphate and copper sulphate-nicotine sulphate solutions discussed in the section on treatment have long been used for the removal of the large stomach worm. Phenothiazine has recently been found to be very effective, also, and for a discussion of its use the reader is referred to the section on general treatment.

Small Thread-Like Stomach Worms

The small stomach worms belong to two genera, namely *Ostertagia* and *Trichostrongylus,* and are very much smaller in size than the large stomach worm, *Haemonchus contortus.* The photograph on Page 7 shows some of these small worms in comparison with other species. One species, *Trichostrongylus axei,* occurs in sheep, goats, and horses as well as cattle. These small worms are one-fourth to one-half inch in length and very slender; consequently, they are very easily overlooked at post-mortem examinations. If present in large numbers they can sometimes be detected as tiny thread-like objects if the folds of the stomach are lifted slowly. The most successful way to recover them, however, is to wash the contents of the stomach and mucus rinsed from the walls into a bucket or garbage can holding three or four gallons of water. After allowing the sediment to settle 10 to 15 minutes, pour off almost all the water, fill the can, and again allow to settle, repeating the process until the water stays nearly clear. Some of the contents may then be examined in a glass jar or dish, preferably against a dark background. Generally these worms, if present in large numbers and if the calf has not been dead too long, will have a distinct reddish color when thus cleared of the sediment.

Life Cycle—The larvae of these worms are believed to become infective in about a week and to develop to the adult stage in the calf in from 19 to 31 days after infection, and the adults can live at least seven and one-half months. The life cycle of one of these worms, *Ostertagia ostertagi,* has recently been studied at the Virginia Experiment Station. Eggs of this species hatch in about 24 hours and reach the infective stage in five to six days. The infective larvae become adults in about three weeks after gaining entrance to the digestive system by way of the mouth. The larval stages of these parasites are very resistant to adverse external conditions and have been found to remain infective on dry hay for over a year.

Symptoms—While pure infections of these parasites have not been studied, observations indicate that they do considerable injury when present in large numbers. There does not seem to be any difference between the symptoms produced and those developed in infections by other parasites insofar as general observations go.

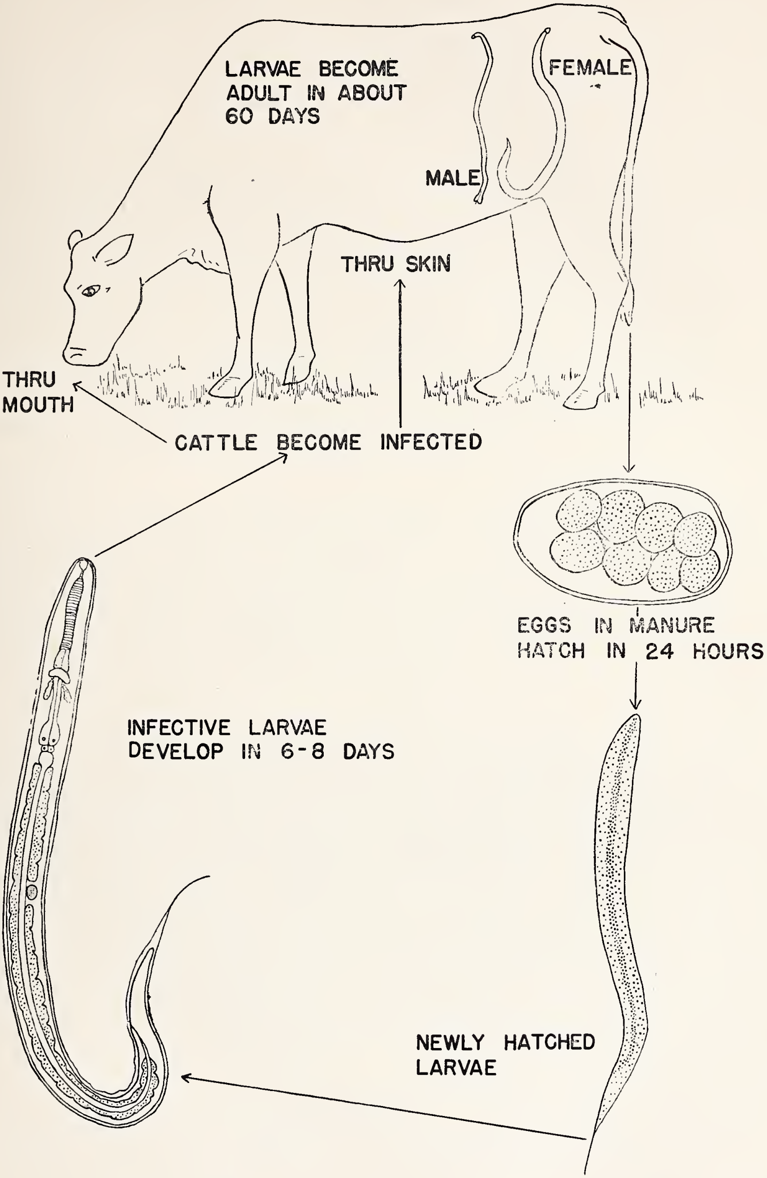
Treatment—The various treatments recommended for the removal of parasites are not very effective against these species, possibly because they are found embedded in the layer of mucus in close contact with the lining of the stomach and consequently are not attacked by the drug. Phenothiazine is recommended as the most effective drug for their removal. A discussion of its use will be found in the general section on treatment (Page 42).

PARASITES OF THE SMALL INTESTINE

The Hookworm

This parasite (*Bunostomum phlebotomum*) is found in the anterior half of the small intestine, chiefly in the first eight or ten feet. A very few are usually recovered from the fourth stomach. These worms are about one-half to three-fourths inch long, relatively larger in diameter than the large stomach worm, and distinctly whitish in color. The females are for the most part noticeably larger than the males. The photograph on Page 7 shows the hookworm in comparison with other species. The two specimens on the left are males.

Life Cycle—The stages in the life cycle are shown in the diagram on Page 13. The eggs are laid in the contents of the intestine by the females and pass out with the manure. Hatching takes place in about 24 hours and the larvae develop to the infective stage in seven to eight days during summer temperatures in Louisiana. Infection takes place by way of the mouth or by penetrating the skin while the calf is lying down on contaminated bedding or ground in the shade or pasture. Infection with severe symptoms and death has been produced in our experiments at Louisiana State University by placing the larvae on the skin. The time


LARVAE BECOME ADULT IN ABOUT 60 DAYS
FEMALE
MALE
THRU SKIN
THRU MOUTH
CATTLE BECOME INFECTED
EGGS IN MANURE HATCH IN 24 HOURS
INFECTIVE LARVAE DEVELOP IN 6-8 DAYS
NEWLY HATCHED LARVAE
LBoss

LIFE CYCLE OF HOOKWORM

required for the larvae to develop to maturity in the calf varies from 52 to 79 days. During this time the larvae pass to the lungs, penetrate the tissues of the air spaces, and are coughed up and swallowed and complete their development in the intestine. Larvae have been recovered from the lungs of both sheep and calves and it is possible that their presence there plays a part in the development of pneumonia although this has not yet been determined.

Symptoms—Diarrhea has been found to develop in about a month after inoculation. There is a loss of flesh, unthriftiness, and other symptoms of parasitism. These observations agree with those made on sheep inoculated with the species of hookworm parasitic in sheep. It is evident that the symptoms of parasitism were caused by the larvae and not by the adults, since no parasite eggs of any kind were recovered from the manure during the period of diarrhea. During the period of adult life of the worms no symptoms developed. The length of life of the adult worms in the calf may be at least ten months judging by the presence of eggs in the manure. It has been found that calves develop an immunity or resistance to this species in a manner much like they do to the large stomach worm and to the nodular worm.

Treatment—The copper sulphate-nicotine sulphate solution described in the general section on treatment has been recommended for removing the adult hookworms. A small number of experimental results with phenothiazine indicate that it is effective in removing this species although not as effective as against the large stomach worm and the nodular worm.

The Cooperias

Five species of small roundworms belonging to the genus Cooperia infect calves. Two of these are not of great importance according to reports to the present time. No common name has been established for these parasites. They are relatively small, less than half an inch long, very slender and hair-like, and somewhat reddish in color when alive. The photograph on Page 7 shows some of these worms. They are more numerous in the front portion of the small intestine. Their resemblance to some of the fine sediment present in the contents is so close that it is sometimes necessary to examine them under the microscope to be certain of their identity. They are likely to be overlooked because of their small size unless the washing procedure described for the recovery of the small stomach worms is carried out.

Life Cycle—The life cycle of one of these, *Cooperia punctata,* has recently been studied in detail by Dr. W. S. Bailey at Alabama Polytechnic Institute, Auburn, Alabama. The details of the other species are probably similar to *C. punctata* and to the species found in sheep. Larvae hatch from eggs passed in the manure by infected animals and develop to the infective stage in about a week. After reaching the digestive tract of the calf, the larvae develop to sexual maturity and begin passing eggs in from 11 to 16 days.

This parasite is capable of producing severe symptoms such as diarrhea and loss of weight and appetite. The anterior 10 feet of the small intestine show numerous tiny hemorrhagic spots and occasionally larger areas are affected in this manner. Beyond the first 10 feet these spots gradually decrease and the posterior half of the small intestine appears normal. Larvae and adults may be found embedded in the wall of the anterior portion of the intestine, but generally they are found only in the contents.

The length of life of the adults was found to be as long as nine months but was always shortened by additional inoculations with infective larvae. In all of seven calves an active immunity was demonstrated which was sufficient to protect the animals against reinfection even when a large number of larvae were given. In one controlled experiment there was no evidence of a protective age resistance up to 12 months.

Treatment—No effective treatment has been recommended for the removal of the adult Cooperias. Phenothiazine removes only a small percentage, according to experimental results.

The Ascarid

This parasite (*Neoascaris vitulorum*) is found in the small intestine of cattle. It is a very large worm 6 to 12 inches in length and has approximately the diameter of a pencil.

Life Cycle and Symptoms—The stages of the life cycle and symptoms produced by this parasite have not been studied, but they are probably similar to those of the closely related species found in pigs (*Ascaris lumbricoides*). The eggs are laid by the females in the contents of the intestine and pass out with the manure. Unlike many other roundworm eggs, the larvae do not hatch outside the animal but develop to the infective stage within this shell in about two weeks. It has been found that within the shell these larvae are very well protected against external conditions, such as drying, freezing, and chemicals, and may remain alive for years in some types of soil and in the shade. Infection takes place by way of the mouth. The larvae hatch in the intestine, penetrate the intestinal wall, and pass by way of the blood to the lungs, where they penetrate the tissues of the small air sacs and enter the air spaces. In the course of time they find their way up the air passages to the throat, are swallowed, and upon reaching the intestine complete their development. The presence of the larvae in the lungs of pigs causes a large amount of irritation and inflammation, and pneumonia is a frequent result. It is not known whether the larvae of the cattle ascarid play any part in pneumonia in calves, but it is possible that they do.

Thread-Necked Worms

These worms are half an inch to an inch long and have the head end somewhat more slender than the other. They are found in the small intestine and are highly reddish in color when alive. Two species have been distinguished, *Nematodirus spathiger* and *N. helvetianus*.

Life Cycle—The stages of the life cycle have not been studied in the calf and therefore it is necessary to draw upon information from infections of these parasites in sheep. Eggs are passed out in the manure, but unlike other roundworms of cattle and sheep, the larvae do not hatch until they reach the infective stage. They are unusual also in that they develop very slowly and require from 24 to 28 days before the larvae are ready to hatch. The larvae are very resistant to cold and drying and have been found to live in water for over eleven months. Infection takes place by way of the mouth, and the time required for the larvae to reach maturity and the worms to start laying eggs in the sheep is about one month.

Symptoms—Since experiments using pure infections of this parasite have not been carried out, information regarding the symptoms is not available at present. Since heavy infections with these parasites seem to be rare, they are not considered to be the cause of a large amount of damage, but it is possible that they contribute to the injury caused by other parasites.

Strongyloides Sp.

These are very small roundworms nearly microscopic in size that are found in the small intestine. They are so small that they will be overlooked at post-mortem examinations unless a special effort is made to recover them. A microscopic examination of the manure will reveal the presence of the eggs. Observations of calves under controlled conditions of infection indicate that these worms can be the cause of an intermittent diarrhea and a generally upset digestive system that result in the calf's being in poor condition for a long period of time. The diarrhea will improve for a few days or a week or two, then recur. Observations to date point to skin penetration as an important manner of infection since these animals were obtained within 48 hours after birth and kept under conditions that precluded infection after that time. It seems very probable that some of the cases of diarrhea that do not respond to the usual treatments are caused by this parasite. This fact can only be determined by a laboratory examination of the manure for the presence of the eggs. Specific treatments have not been worked out to date.

ROUNDWORMS OF THE ABDOMINAL CAVITY

Frequently when cattle are being slaughtered for meat or at a post-mortem examination, long slender white worms two to four inches in length will be found in the fluid from the body cavity or among the internal organs. The photograph on Page 7 shows some of these worms in comparison with other species. These are commonly called body cavity worms and have the scientific name *Setaria labiatopapillosa*. They, insofar as is known, do not cause any damage to the cattle and do not injure the meat in any way for human consumption. Although the life history of these worms has not been studied, it is probable that it is similar to that of related species found in other animals. Eggs are not produced, but larvae deposited in the body fluids, such as lymph and blood, are transmitted to new hosts by bloodsucking insects.

PARASITES OF THE LARGE INTESTINE

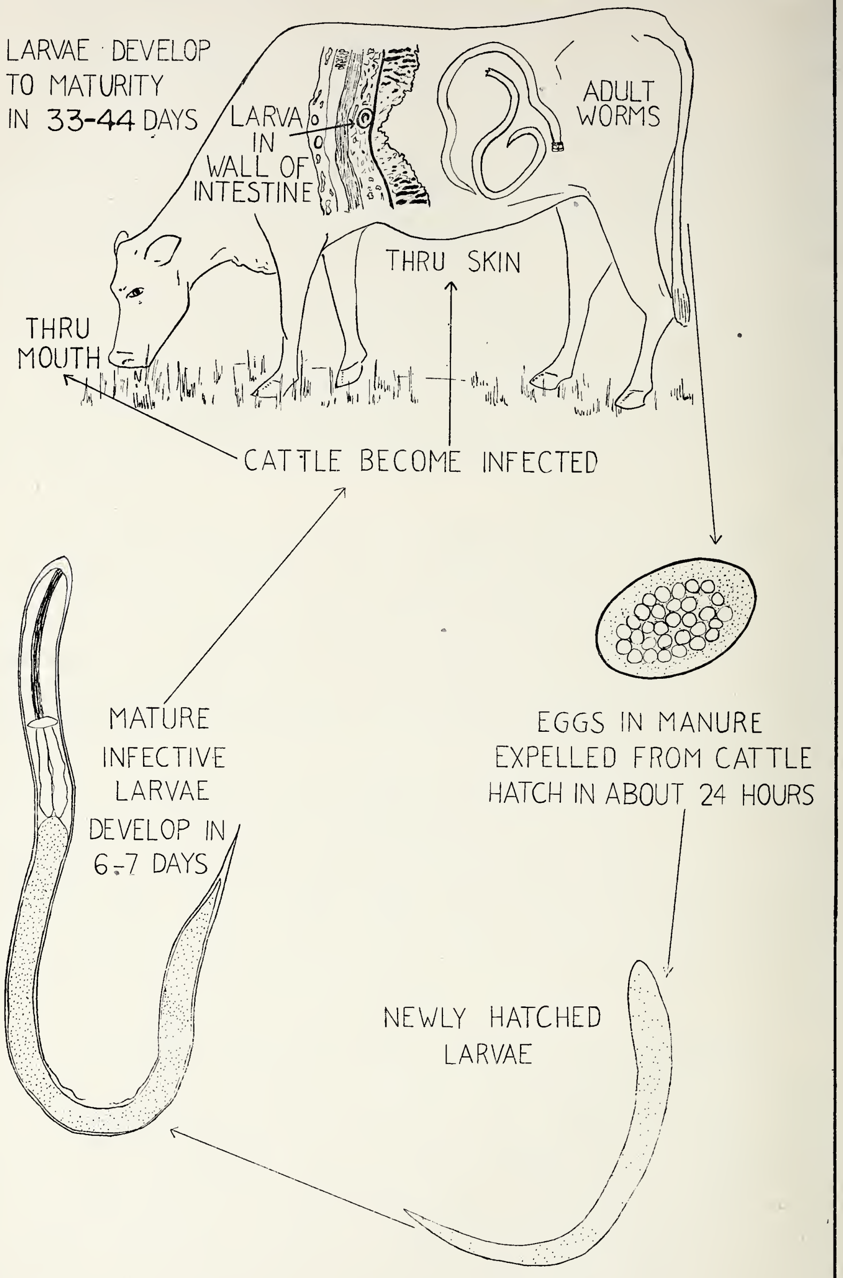
The Nodular Worm

This parasite is called the nodular worm because of the small, hard lumps or nodules which the larvae cause to develop in the walls of the posterior portion of the small intestine and caecum. The scientific name of this worm is *Oesophagostomum radiatum.* A related but different species, *O. columbianum,* occurs in sheep. The adults are to be found in the caecum and anterior portion of the large intestine and are about one-half inch long. They differ from the other roundworms of cattle in that a portion of the anterior end is bent in the shape of a walking cane, and the females for the most part have a dark colored spot near one end. The photograph on Page 7 shows some of these worms in comparison with other species. The three smaller specimens on the left are males and the others are females.

Life Cycle—The eggs which are deposited in the manure hatch in about 24 hours at a temperature of 70 to 85 degrees. A diagram of the stages in the life cycle will be found on Page 18. The larvae reach the infective stage in about five days after the eggs are expelled in the manure. Infection takes place very readily by way of the mouth, the larvae being acquired on contaminated grass or hay cut from infested pastures. After infection has occurred the larvae reach maturity and begin laying eggs in from 33 to 43 days.

Experiments at the Louisiana Agricultural Experiment Station indicate that the larvae also produce infection by penetrating the skin. The larvae were placed on the skin of the flanks of two calves that were free of parasites and kept under conditions free of parasitic infection. They were then placed in stanchions so they could not lick themselves until the eggs appeared in the manure. Therefore, it seems advisable to consider that poorly cleaned barns and the contaminated soil of shade areas as well as the pasture are potential sources of infection. Calves also may lick the larvae from their hair after lying down in contaminated places.

Symptoms—The larvae, upon reaching the posterior half of the small intestine and caecum, penetrate the tissues of the wall until they get about halfway through. There they grow and develop partly into the adult stage, and their presence causes severe disturbances which result in thickening of the wall and rupturing of small blood vessels, causing bleeding into the intestinal cavity. These disorders interfere with normal digestion and absorption and cause a diarrhea of varying degrees of severity. The discharge becomes very watery, sometimes is bloody, and usually has a very disagreeable odor. The calf may begin to lose its appetite in four or five days after inoculation. Some become very weak, anemic, and emaciated and those that survive the acute stages of the in-


LARVAE DEVELOP TO MATURITY IN 33-44 DAYS
LARVA IN WALL OF INTESTINE
ADULT WORMS
THRU SKIN
THRU MOUTH
CATTLE BECOME INFECTED
EGGS IN MANURE EXPELLED FROM CATTLE HATCH IN ABOUT 24 HOURS
MATURE INFECTIVE LARVAE DEVELOP IN 6-7 DAYS
NEWLY HATCHED LARVAE

LIFE CYCLE OF NODULARWORM

LBoss

fection will remain in a weakened condition for a month or two before they show much improvement. Some individuals gain very little weight while others lose weight rapidly during the time the larvae are in the intestional wall. After the larvae leave the intestinal wall and remain in the cavity of the large intestine the damaged tissues heal and the animals begin to show some improvement in condition, although they may remain weak, in poor flesh, and with a rough coat for months. Some individuals in our experiments that live, improve slowly with good feed and care for six months or more and then die quite suddenly when the feed gets less nutritious and the weather, unfavorable. This probably accounts for the deaths of some animals during winter or conditions of poor feeding and management. In these experimental animals the number of eggs was very greatly reduced and very few worms were recovered at post-mortem examination, an indication that it was not the adult worm that was the cause of the condition of the animals. Treatment of animals in such a weakened condition may result in their death, since the drugs which kill the adult worms are more or less poisonous to the calves as well as to the worms. Nothing is known about the removal of the larval stages by treatment. Good care, good feed, and protection from unfavorable weather are of first consideration for animals suffering from such parasitic infections.

Animals that survive the acute stages of larval nodular worm infection regain their strength to some extent during the adult stage of the parasites. Eventually they develop an immunity or resistance to the adults, as indicated by the number of eggs recovered from the manure. The beginning of this immunity is indicated by a sudden decrease in the number of eggs and its continuation by the fact that when the animals are reinoculated the larvae are not allowed by the calf to develop into adults and no symptoms of infection develop. Some of these animals have been repeatedly reinoculated and some placed in a heavily contaminated pasture where nonresistant animals died from acute infections. These animals remained free from symptoms and the number of eggs in the manure did not increase. That the immunity is permanent is indicated by the fact that some of these animals were kept in this pasture for five and six years after the resistance was set up, with no increase in the infection. The development of immunity probably accounts for the fact that older animals usually have relatively few parasites.

Treatment—Phenothiazine as discussed in the general section on treatment is recommended as the most effective and safest treatment for the removal of these worms.

The Whipworm

The whipworm (*Trichuris ovis*) is found in the caecum or blind gut of cattle, sheep, and goats. It gets its common name from its resemblance to a whip and consists of a long slender anterior portion corresponding to the lash and a thick posterior portion corresponding to the handle. The total length is two to three inches, two-thirds or more of the total being slender. The color of the worms is white. The photograph on Page 7 shows some of these worms in comparison with other species.

Life Cycle—The life cycle has not been studied in cattle or sheep, but it probably closely resembles that of related species in man and dog. In these related species the eggs do not hatch, but the embryo develops to the infective stage within the protective shell. When the eggs are swallowed the embryos are freed in the digestive organs and develop to the adult in the caecum.

Symptoms—The slender anterior ends of the worms are usually found piercing in and out as if sewed into the inner layers of the caecal wall. In man when the worms are numerous a low grade inflammation is set up; in dogs severe symptoms may develop; but in cattle and sheep it is not thought that any serious damage is done. It would seem, however, that bacterial invasion of the tissues might easily follow the penetration of the anterior portions of these worms into the tissues and be a contributing factor to the effects of other parasites if the infection is heavy.

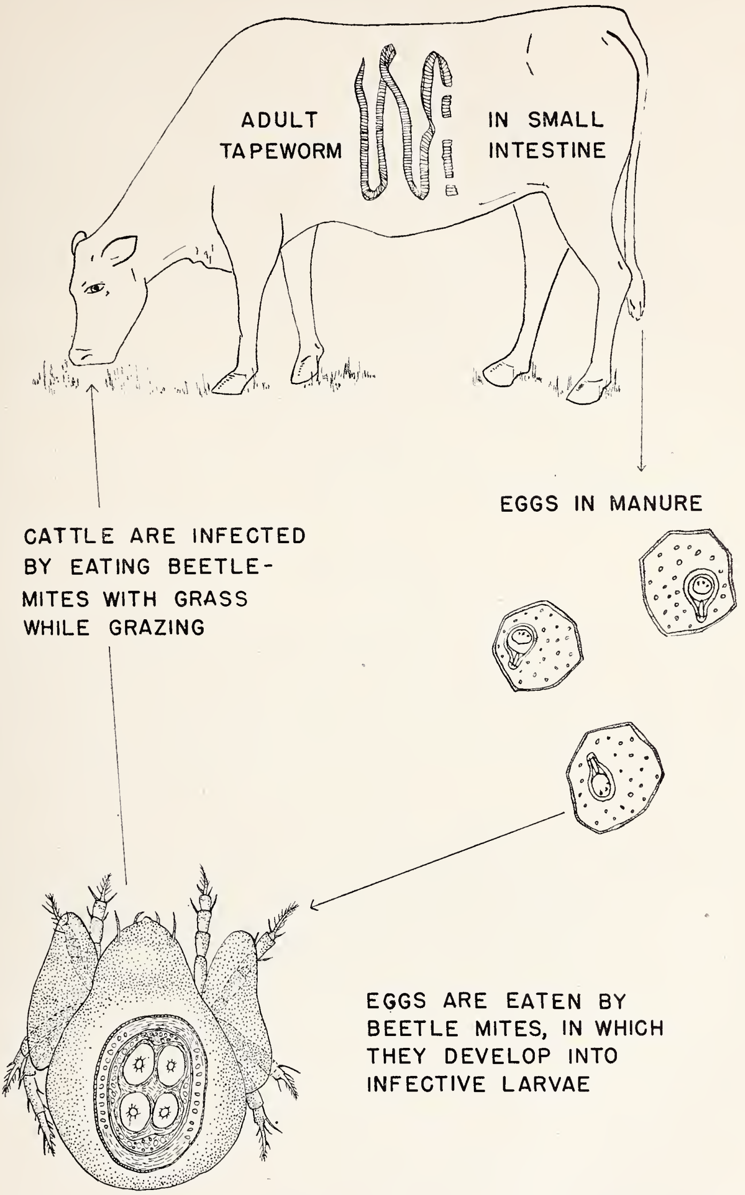
Treatment—No effective treatment is known for the removal of these parasites.

TAPEWORMS

Tapeworms are long ribbon-like parasites in the adult or egg producing stage found in many of our domestic animals. The eggs that are produced by the adults must undergo a period of larval development in another kind of animal before the adult stage is again reached. As an example, the tapeworms that are found as adults in cattle undergo their larval development in small grass-mites similar to red bugs, and one of the species that pass their larval development in cattle has its adult form in man. Cattle are susceptible to infection with the adult forms of two species and with the larval forms of two species.

Adult Forms

The Moniezias—The two species of this genus found in cattle are *Moniezia expansa* and *M. benedeni*. They are indistinguishable from each other in size and external appearance but differ internally. They are found in the small intestine and are flat ribbon-like worms many feet long. Lengths up to 30 or 35 feet may be recovered although they are generally broken into shorter pieces in the process of opening the intestine. Upon examination they are found to be divided into joints or segments and if an entire worm is followed to each of the ends, one will be found to widen to a maximum of three-fourths of an inch. The other end will become narrower and at the very end will be found a small bead-like structure, the head or scolex by which it attaches itself to the wall of the intestine. The photograph on Page 7 shows a small portion from the central region of a tapeworm.


ADULT TAPEWORM
IN SMALL INTESTINE
EGGS IN MANURE
CATTLE ARE INFECTED BY EATING BEETLE-MITES WITH GRASS WHILE GRAZING
EGGS ARE EATEN BY BEETLE MITES, IN WHICH THEY DEVELOP INTO INFECTIVE LARVAE

LIFE CYCLE OF TAPEWORM

LBoss

Life Cycle—A diagram of the stages in the life cycle of these tapeworms is shown on Page 21. The eggs escape to the outside in the manure, but in order for them to develop into adult worms they must be eaten by small mites. These small mites are similar to red bugs in some respects. They frequent the soil and vegetation and feed, insofar as is known, on decaying vegetation, bacteria, molds, etc., in decomposing manure containing the eggs. Within these mites the tapeworm eggs hatch and the small embryo develops to the infective stage. The infected mite is carried into the digestive tract of cattle, sheep, and goats on contaminated feed, where the larvae are freed from the mite and develop into adult tapeworms. Infection experiments have not yet been carried out using cattle, but in sheep the larvae require about 40 days to reach maturity and the adult worms continue to produce eggs for about two months. Development of the larvae in the mite requires three and one-half to four months. Some experimental observations indicate that pastures can remain infective 17 to 22 months.

Symptoms—There is some disagreement as to the amount of injury done by the tapeworms, but experimental observations carried out with sheep indicate that no serious damage is done. No observations have been made on cattle. Animals under field conditions are usually found to be infected with other parasites as well, so that it is difficult to assign to each the exact amount of damage.

Treatment—An effective treatment for the removal of these worms has not been found. Among those that have been recommended are kamala, copper sulphate, oleoresin of male fern, nicotine sulphate, and sodium arsenite. The effectiveness of these, however, seems to be still in question and, besides, they are more or less toxic and dangerous to the animal.

Larval Forms

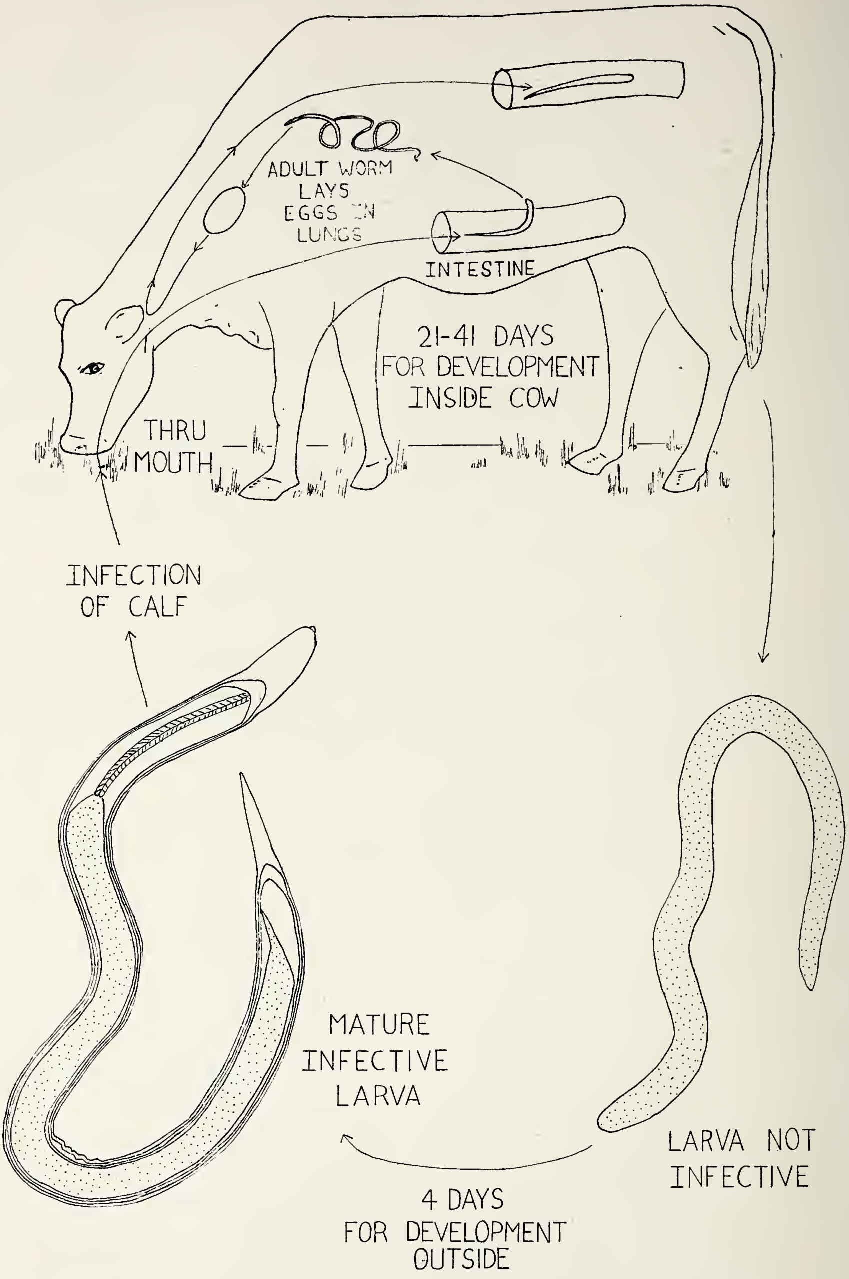
Beef Measles—This condition of beef is caused by the presence of the larvae of a species of tapeworm found in man and may be recognized by the presence of small, whitish spherical or elliptical cysts one-eighth to three-eighths of an inch in size, more or less embedded in the muscle. They are usually most numerous in the jaw muscles and the heart but may occur in any part of the body. These larvae develop into the adults of the tapeworm *Taenia saginata* in the intestine of man when the infected beef is not sufficiently cooked to kill the larvae. It should be emphasized that such meat should be thoroughly cooked if the larvae are to be killed. The eggs deposited by the adults are passed in the human feces and cattle become infected from contaminated pastures or feed in the feed lots. Upon gaining entrance to the digestive system of cattle, the larvae are freed from the shell, then penetrate the intestinal wall and gain access to the circulatory system, by which they reach the heart muscles or other parts of the body in which they develop further. Infected meat may be made safe for food by thorough cooking or refrigeration at the proper temperature and for sufficient time. Insofar as is known, no symptoms are produced in cattle by the infection. However, a very real danger exists if the infected beef is not properly handled and infection in man prevented.

The Hydatid Cyst—The hydatid or echinococcus cysts contain the larval forms of a tapeworm parasitic in dogs and other carnivorous animals. These cysts are whitish, tough-walled objects more or less embedded in the livers of cattle and hogs. They vary in size from one-fourth inch to as large as six inches in diameter and, although most commonly found in the liver, may develop in the lungs and several other organs. Infected livers should not be fed to dogs, since dogs very readily become infected with the small adult tapeworm about one-half inch in length, a very large number developing usually from even a single cyst. The injury done to cattle by the cysts is not great unless the number is very large. However, infected portions of livers and, if heavily infected, the entire organ, must be discarded. This is a cause of considerable economic loss. Another danger of considerable consequence, although not common, is the possibility of accidental infection with the cysts of persons who are associated with dogs infected with the adult tapeworms.

LUNGWORMS

The lungworms are parasites of the trachea and bronchial tubes of the lungs and are especially serious in calves. They are rather long, whitish, thread-like worms two to four inches in length and are found by opening the bronchial tubes, which are the air passages leading into the lungs. These air passages should be followed out to the smaller divisions and the walls and especially the frothy mucus that may be present examined for the presence of the worms.

Life Cycle—A diagram showing the stages of the life cycle of the lungworm is shown on Page 24. The adult females deposit the eggs in the air passages of the lungs where some hatch and the larvae, together with the unhatched eggs, become entangled in the mucus and are coughed up and swallowed. The eggs that have not hatched in the lungs hatch in the intestine and the larvae are discharged in the manure. These larvae are not infective but require about four days in the open in which to develop to that stage. Infection occurs by way of the mouth on contaminated hay, grass, or in water. The larvae, upon reaching the intestine, penetrate its wall and gain access to the lymphatic system in which they travel to the lungs, reaching there in about ten days. The larvae, when swallowed in large numbers, may cause digestive disturbances as they penetrate the intestinal wall, and diarrhea may develop. In a similar manner, as they enter the air passages of the lungs from the capillaries they cause tiny hemorrhages which may lead to pneumonia. The irritation caused by the adults is said to be the most serious result from infections with this parasite. The larvae reach maturity in three to four weeks after being swallowed.



LIFE CYCLE OF LUNGWORM

Symptoms—The adult worms cause a catarrhal condition which results in excessive mucous formation sometimes colored with blood. This mucus contains the eggs and hatched larvae of the adult worms and is coughed up and for the most part swallowed. Severe infections cause difficulty in breathing, discharge from the nose, and a general unthriftiness manifested by loss in weight, rough coat, and sometimes diarrhea. Pneumonia may also develop as a result of the larvae penetrating the walls of the air passages on their way from the blood vessels to the lungs and also as a result of the irritation developed by the adult worms.

Treatment—The subject of treatment of lungworm infections is considered at this time because the methods are so different from those employed in other parasitic infections. In general, the treatment of animals infected with lungworms has proved unsatisfactory up to the present time. The various methods that have been employed may be grouped under the following heads:

1. *Administration of drugs as liquids into the trachea.* Among those tried are chloroform, turpentine, iodine, creosote, benzene, pyrethins in olive oil, and carbon tetrachloride.
2. *Administration of drugs as vapors into the trachea.* Among those tried are ether, oil turpentine, sulphur dioxide, chloroform, chlorine, ammonia, and formalin.
3. *Administration indirectly through the digestive tract and intravenous and intramuscular injections.* Carbon tetrachloride when administered by mouth is eliminated by the lungs and in this way it comes in contact with the worms, but it is very dangerous to cattle. Various copper salts have been tried by intravenous and intramuscular injection but not with promising results.

While experimental results show that some of these drugs kill some of the worms, the introduction of such substances into the lungs and otherwise into the animal in many instances has resulted in very serious damage. Most of these substances, it will be noted, are highly irritating to the delicate membranes lining the respiratory passages and, consequently, when present in sufficient quantity to kill the worms, produce complications that often lead to serious results.

Care of Infected Animals and Prevention—The best procedure to follow in handling animals infected with lungworms is to provide the best of care possible in the way of shelter, feed, and pure water and to remove the animals from the source of infection so as to prevent the infection from increasing—in short, to do all that is possible to aid the infected animals to live with the parasites until they outlive them and to prevent reinfection. Calves especially should not be allowed to graze with older animals that are infected or be pastured on the ground formerly grazed by such animals. Low, wet pastures should be avoided, overstocking should not be allowed to occur, especially where young stock is concerned, and a plan of rotation should be adopted if possible. Resting a well-drained pasture for six weeks will usually allow the infective larvae to die out. Longer periods, however, are advisable if it is at all possible. It has been determined that the adult worms may live in the lungs from one to four months.

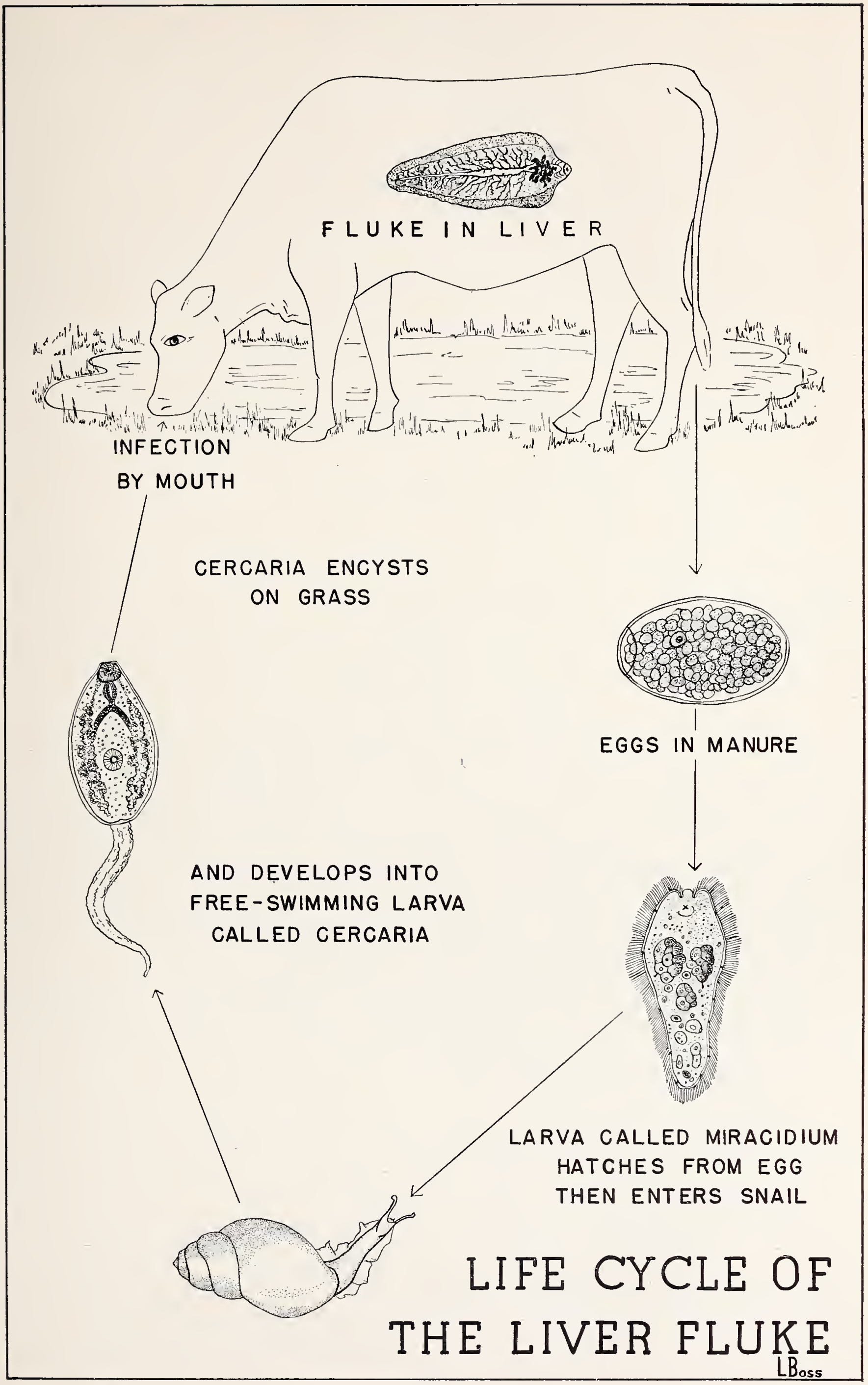
LIVER FLUKES

Common Liver Flukes

The common liver fluke (*Fasciola hepatica*) is a flat leaf-like worm one-half to one and one-fourth inches in length and is found in the bile duct and gall bladder of cattle, sheep, goats, and sometimes pigs. It is also found occasionally in the lungs as well as in the liver. The photograph on Page 7 shows some specimens of this parasite in comparison with other species. The walls of the bile ducts are more or less thickened depending on the number that are present and have a gritty, calcareous deposit adhering to their inner lining. The flukes are freed by cutting open the ducts. They are sluggish, flat worms with a small, cone-like projection at one end bearing a tiny, dot-like depression, the oral sucker. On one of the flat surfaces a short distance from this cone-like projection is the ventral sucker. When examined under the microscope, the surface of the fluke is found to be covered with minute, sharp spines which contribute to the irritation of the walls of the bile ducts causing the changes described above. In some instances the damage to the duct wall and the resulting deposits of calcareous material are so great as to obstruct the flow of bile. There is also a large amount of damage done to the liver tissue during the wandering of the larvae through it, referred to later under "Life Cycle." This results in the formation of whitish, tough scar tissue which not only interferes with the normal functions of the liver, but also renders it tough and unfit for food.

In the United States the liver fluke is found in the Pacific Coast, the Rocky Mountain, and the Gulf Coast states. It is prevalent in low, wet pastures and wherever suitable snails are present for the development of the larval stages. The economic losses from liver fluke infections have been listed under the following headings: livers unfit for food at slaughtering, loss of flesh due to resulting unthriftiness, loss due to deaths, decreased milk production, and reduced breeding efficiency, due to the unthrifty condition. The exact amount in dollars, of course, cannot be determined, owing to the impossibility of securing accurate and complete information, but it must be a large sum annually.

Life Cycle—The stages in the life cycle of liver flukes are shown in the diagram on Page 27. The eggs are laid in the bile ducts and pass to the intestine in the bile and then out of the digestive tract in the manure. A small larva called a miracidium hatches from the eggs in from seven to 10 days and, in order for it to develop further and be able to produce infection, it must penetrate the body of certain species of snails. The particular kind of snail necessary is a water snail and is found in moist and marshy places only. After it penetrates the snail, several developmental and multiplication stages develop from this small larva. As a re-


FLUKE IN LIVER
INFECTION BY MOUTH
CERCARIA ENCYSTS ON GRASS
EGGS IN MANURE
AND DEVELOPS INTO FREE-SWIMMING LARVA CALLED CERCARIA
LARVA CALLED MIRACIDIUM HATCHES FROM EGG THEN ENTERS SNAIL
LBoss

LIFE CYCLE OF THE LIVER FLUKE

sult several hundred small tadpole-like organisms, the cercariae, in the course of time escape from the snail and encyst on grass or other objects. In this condition they wait until they are taken into the digestive organs of the cow. In this encysted condition the cercariae are able to withstand a certain amount of heat and drought although they are in time killed by the hot, dry weather of summer. The total time required for the development in the snail is about seven weeks.

When the cercariae are taken into the intestine with grass or hay, they penetrate the wall and wander about in the abdominal cavity until they come in contact with the liver. Then they penetrate this organ and feed on its tissues for about two months. During this time they burrow about, causing a large amount of injury and destruction of the living tissue which nature attempts to heal by the formation of the tough, whitish scar characteristic of healed wounds. This can be seen on the surface of the livers of fluke-infected animals that have been slaughtered. This destruction of the liver and the formation of the resulting scar reduces and interferes with the normal functions of the liver and renders it unfit for food when animals are slaughtered for meat.

After about two months spent in the liver, the larvae resemble small adult flukes in appearance and are now ready to pass into the bile ducts where they grow and develop into adult flukes in about a month. Under favorable conditions the complete cycle of stages of development may be completed in about five months but may be delayed to some extent by external factors such as low temperatures.

Symptoms—The symptoms of liver fluke infections do not differ in essential details from those of other parasitic diseases. Animals with light infections sometimes remain in an unthrifty condition in spite of good pasture and care and fail to respond with the expected gains when put in the feed lot. Where the infection is heavy, animals go down in condition with the general symptoms of other parasitic infections and death is invariably the result, especially if the animals are young. The finding of the liver fluke eggs in the manure by an experienced laboratory worker is necessary to determine the presence of adults.

Treatment—If liver fluke infection is suspected, the owner should, if at all possible, consult a competent veterinarian or communicate with his state livestock sanitary board for advice and assistance in diagnosis and in the administration of the drugs.

Carbon tetrachloride has been recommended as a treatment, but, while it seems to destroy the flukes rather effectively, it is so toxic to cattle that it is dangerous to use. The drug is especially toxic to milking animals and to those in a weakened condition.

Recent experiments indicate that hexachlorethane is an effective treatment for the removal of the adults in the bile ducts but does not affect the larvae that are still in the liver. It should be remembered that the larvae are the cause of serious and permanent damage to the animal and that a complete cure of all animals is impossible, since nature is powerless to repair all the damage done by the larvae. A very important thing to remember about the employment of treatment is the destruction of the adults and, consequently, the elimination of the eggs as a source of infection for other animals during the present and following seasons. It is advisable to continue the treatment of animals on infected pastures for several seasons in order to prevent the number of parasites from increasing and reaching dangerous proportions. Treatment of infected animals that have not been too seriously damaged by the larvae is said to result in rapid improvement.

The following directions for the use of hexachlorethane are quoted, by permission, from a circular by Dr. O. Wilford Olsen, associate zoologist, Bureau of Animal Industry, Zoological Division, U.S.D.A., who has made an extensive study of the use of hexachlorethane at the Texas Agricultural Experiment Station at Angleton, Texas.

"The drug should be prepared as an aqueous suspension and administered as a drench.

"The hexachlorethane suspension is prepared by mixing the ingredients on the basis of one pound of finely ground hexachlorethane (60-mesh size) and 1½ ounces of bentonite (a finely powdered clay) with 25 ounces or slightly over 1½ pints of water. The addition of about one-quarter teaspoonful of white flour facilitates the mixing and improves the resulting suspension. Mixing should be done with a power-driven apparatus of sufficient speed and force to insure thorough distribution of the ingredients. When mixed in the above proportions approximately one quart of the suspension is produced.

"Large quantities of the suspension may be prepared by using a barrel and mixing apparatus of sufficient speed and power to obtain thorough mixing. An outboard motor makes a very satisfactory mixer. In using an outboard motor, caution should be taken to prevent the hexachlorethane from being pumped into the cooling system where it will cause corrosion. This may be done by disconnecting the pump; passing a stream of water in the motor by means of a hose leading from the pump to a faucet will prevent overheating. When preparing large quantities of the suspension, the bentonite and the flour should be added slowly to the water while stirring it rapidly with the mixer. After the water and bentonite are well mixed, the hexachlorethane is added slowly while continuing the stirring. The prepared suspension may be stored in gallon jugs.

"A measured dose of 6½ ounces of the suspension for cattle and 3¼ ounces for calves over three months old is given by means of a metal dose syringe of 4-ounce capacity or greater. Calves under three months of age need not be treated because any flukes they may harbor would be too young to be killed by the treatment."

The drug is available in prepared form from veterinary supply houses and when purchased from such a source care should be observed to follow the directions given by the manufacturer for administration.

"When administered as an aqueous suspension, hexachlorethane has a wide margin of safety for the treatment of all classes of range cattle, with the exception of very debilitated ones. Extremely weak animals should be treated with caution since, occasionally, unfavorable effects such as staggering and reeling, sometimes prostration and death, may result from giving a full dose.

"One dose of hexachlorethane suspension is usually sufficient to kill the adult flukes in the bile ducts; young flukes are somewhat resistant to the treatment. The dead flukes pass from the liver by way of the common bile duct into the intestine and to the outside with the droppings.

"In cases where the poor or unthrifty condition of the cattle is due to liver flukes, there is generally a remarkable improvement in the weight and appearance of animals within a short time after treatment with hexachlorethane. Exceptions occur, however, in instances where the damage to the liver is so extensive that the animals are unable to recover, even though the flukes that they harbored are destroyed.

"In planning a program for controlling liver flukes, the time of treatment should be chosen so as to take advantage of the weakest point in the life cycle of the fluke. In general the flukes are the most vulnerable in the spring and fall, and it is probably at this time that the treatment may be given most advantageously.

"In the Gulf Coast region, the season of snail activity is during the mild, wet winter and spring. It is during this time that the infective stages of the liver fluke are able to come out of the snails and get on the grass. Treatment of all the cattle in the herd in the spring, or at the beginning of the dry season, when the snails go into the soil, and again in the late fall before the onset of the wet season, gives excellent results. This arrangement takes advantage of the fact that many of the cysts on the pasture have been killed by the heat and drought during the summer, and the majority of the flukes already in the liver are mature and readily killed before the snails become active again in the winter.

"In regions where cattle are taken off pastures and not subjected to continuous infection during the cold winter months, treatment should be given at the time when the animals are removed from the infested range in the fall and again in the spring before they are returned to it. The fall treatment kills the flukes that have reached maturity during the grazing season and the spring treatment destroys those flukes that were too small to be readily killed at the time of the first treatment. Animals treated in this manner should be practically free of parasites when they are returned to the range. Such a program not only kills the greatest number of flukes, but also reduces the possibility of infection of more snails on the pasture the next grazing season. A program of drenching cattle twice a year, however, will not eradicate liver flukes, but it will greatly reduce their numbers and improve the health of the cattle."

The Lancet Fluke

The lancet fluke (*Dicrocoelium dendriticum*) is a recent importation to North America and to date is known to occur only in Canada and New York. It has been known to occur in six counties in central New York since 1941. The rapid spread of this newly introduced parasite should be cause for alarm since in Europe it has been found to be a menace to the livestock industry. It is a parasite of many wild and domestic animals and thus could become rapidly distributed and established if the proper intermediate hosts were available. In New York it has been found in the woodchuck, white-tailed deer, cattle, sheep, goat, and horse. Extensive and careful studies have recently been carried out at Cornell University by Drs. C. R. Mapes and W. H. Krull on this parasite and the reader is referred to Volumes 41 and 42 of *The Cornell Veterinarian* for an account of their work.

The lancet flukes are five to 12 mm. in length (.2-.5 inch) and one to 2.5 mm. wide. They are thus much smaller than the common liver fluke which is .5 to 1.25 inches in length and have been mistaken for the larval stages of the latter. The pathological changes resulting from infection with this parasite are confined to the liver. The normal cells are destroyed and become replaced by scar tissue resulting in extensive cirrhosis and thus large areas of the liver cease to function normally. These changes increase in extent and severity with the duration of the infection and no evidence has been found of the building up of an immunity or resistance which develops in the case of some other parasitic infections. Pathological changes of this nature are permanent and, therefore, little improvement in the condition of the infected animal can be expected. No drugs have been found which are effective in removing the parasites up to the present time.

Life Cycle—The life cycle of the lancet fluke differs from that of the common liver fluke in that there are two intermediate hosts instead of one. The larvae that hatch from the eggs that are discharged in the manure of the infected cow, sheep, etc., undergo certain stages of development in a small terrestrial snail (*Cionella lubrica*). These larvae then must enter the body of an ant (*Formica fusca*) where they develop further into the larvae that are capable of infecting the final host. The final host (cattle, sheep, etc.) then become infected by accidentally eating the ants while grazing. The establishment of the parasite in a new location is dependent upon its finding there both of the proper intermediate hosts.

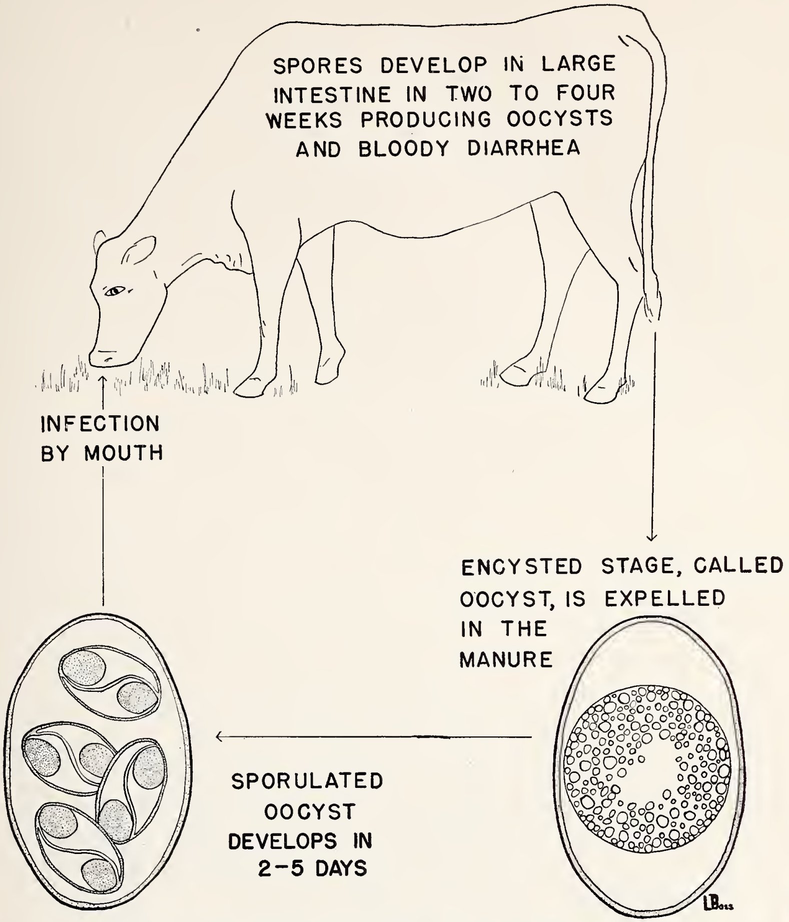
Fascioloides Magna

Another species of liver fluke (*Fascioloides magna*) may be found in cattle in locations where they graze over the same areas as deer. It seems that the deer is the normal host for this parasite and, when it succeeds in infecting cattle, it is encapsulated or walled off and destroyed in the liver; therefore, it does not spread from cattle to cattle, but only the deer serves as a source of infection. There is a considerable amount of damage done to the liver by the larvae of this species and because of this they are of economic importance. Eggs are not discharged in the bile ducts; consequently, infection cannot be determined except at post-mortem examination.

COCCIDIA AND COCCIDIOSIS

The coccidia belong to the group of simple one-celled animals called protozoa and produce the disease called coccidiosis or bloody diarrhea. Coccidiosis occurs not only in cattle but also in chickens, cats, dogs, pigs, sheep, goats, rats, sparrows, etc. There are many species of coccidia involved in the production of the disease and it should be emphasized that species infective for one animal are not infective for another with but very few exceptions. For example, those infective for chickens cannot infect calves, cats, or dogs but only have the ability to develop in the digestive organs of chickens. Therefore, the origin of outbreaks of coccidiosis in one kind of animal should not be blamed on another because they have been in close association. Ten species of coccidia are reported as occurring in cattle in the United States. Workers at the U.S. Regional Animal Disease Research Laboratory at Auburn, Alabama, who have been making an extensive study of the disease have studied nine of these species. These species differ from each other in the size, shape, and nature of the shell of the oocyst and in some other respects such as length of sporulation time, but they do not differ in the main as to symptoms produced. Three species have been found to be the most common cause of outbreaks of the disease. It is not unusual to find coccidial infections in cattle that do not show outward symptoms of the disease. It most commonly occurs in young animals but may develop in yearlings and older animals as well.

Symptoms—The first noticeable symptoms of coccidiosis are diarrhea, which may or may not be bloody, loss in strength, and in general condition. Affected animals become weak and emaciated very quickly and may be unable to stand or even hold up their heads. The diarrhea may have more or less blood mixed with the discharge, is usually severe, and lasts generally only five to ten days. Positive diagnosis of the disease is made by a microscopic examination of the manure and finding the organisms. Calves that survive the first week or two of the attack generally live if other complications, such as pneumonia, do not develop. The loss by death is generally not great even if the animals become very sick, but mortality as high as 50 per cent has been reported. The animals that live usually regain their strength in a surprisingly short time, though severely affected ones may remain out of good condition for months and should be given the best possible care and feed. Animals in a weakened condition from the infection have their general resistance lowered and are more susceptibile to pneumonia; they should be given special protection from the weather and should not be subjected to overcrowding or be forced back from their feed by older or stronger individuals.


SPORES DEVELOP IN LARGE INTESTINE IN TWO TO FOUR WEEKS PRODUCING OOCYSTS AND BLOODY DIARRHEA
INFECTION BY MOUTH
ENCYSTED STAGE, CALLED OOCYST, IS EXPELLED IN THE MANURE
SPORULATED OOCYST DEVELOPS IN 2-5 DAYS

LIFE CYCLE OF COCCIDIA

Life Cycle—A diagram showing the stages in the life cycle of the coccidia is shown above. Calves become infected by having access to feed or water that has become contaminated by manure containing the infective stages of the parasites. The intestine is the region of the digestive system in which the disease develops. The infective stages are microscopic in size and enter the walls of the intestine and there multiply to such an extent that the tissues are ruptured, with the result that the blood vessels are torn open and hemorrhage follows. Inflammation of the delicate tissues, a thickening of the wall, and the general disorders of digestion and absorption manifested by diarrhea and emaciation then result. The organisms known as oocysts that develop as a result of the process of multiplication in the tissues escape into the intestine and are discharged in the manure. These oocysts are round, oval, or pear shaped, depending upon the species, and have a shell that protects them very effectively against certain unfavorable conditions of the outside world. Their internal structure consists of a single cell. At this stage they are not infective. By a series of internal divisions the single cell of the oocyst produces eight tiny cells or spores inside the original shell. This process is called sporulation, and the oocyst is said to be sporulated and is now infective. If enough of these gain access to the digestive system of a calf, they may cause coccidiosis.

Prevention—The time required for sporulation to take place varies from two to five days or more, depending upon the species and environmental conditions. It is during this time that sanitary measures aimed at controlling the spread of the disease must be undertaken. When an outbreak of the disease occurs, the quarters should be thoroughly cleaned of all old manure and bedding and, if possible, cleaned every day or at least every other day for the next week or more to remove the oocysts that are passed by the affected animals before they have time to sporulate and become infective. Too much emphasis cannot be placed on immediate, thorough, and regular cleaning in the prevention of further outbreaks. In case the calves have had access to pasture or a lot, it would be well to confine the affected calves so that all the manure can be collected and disposed of to prevent further contamination of feed or pasture.

Dryness is another factor that is important in preventing the spread of coccidiosis. The oocysts do not live very long if they become dried out. If bedding has been used, it possibly would be better not to put in bedding after cleaning if an outbreak occurs, since bedding tends to hold moisture. Water should not be used in cleaning if the floors are not concrete or board or other material that will dry quickly. Moisture is a very favorable factor in the development of outbreaks of coccidiosis in cattle and chickens as well as in other animals.

It is of prime importance to prevent contamination of all feed and water with the infective stages which are in manure. Hayracks should be so constructed that hay is not pulled out and trampled underfoot where portions may be picked up and eaten. Feed and water containers should be constructed and placed so that manure does not get into them.

While enormous numbers of oocysts are produced during the first few days of the attack, the number rapidly decreases and by the end of a week only a small percentage of the original quantity is given off. Consequently, daily cleaning can be dispensed with after six or eight days, but at least weekly cleaning should be religiously carried out for two or three months, since some oocysts are discharged for a long period and may again build up to dangerous proportions.

The use of *antiseptics* and *disinfectants* has so far proved of little value in the destruction of the oocysts because the shell does not permit the penetration of these substances into the enclosed living cell. Lime scattered on the floor after cleaning has a certain amount of value in that lime absorbs moisture and in this way aids in drying out the quarters, but it cannot be depended upon to destroy the oocysts in any other way.

Effective prevention of outbreaks by the use of *drugs* has so far not given promise of value. In experimentally infected calves sulfaquanadine has been of some value in preventing coccidiosis. However, because of the difficulty in anticipating an outbreak of the disease, it should not be used as a substitute for sanitation.

Too much stress cannot be placed upon *sanitation* and *management practices* in preventing coccidiosis. Where the group of animals is large enough, the practice of separating the calves by age groups and having a series of pens into which each group is moved in succession has been found effective in preventing not only coccidiosis but parasitic infections as well. By this method the younger animals are not subjected to infection in the areas that may have become contaminated by older animals through constant association in a common group. A regular and effective system of cleaning all quarters of all groups is, of course, a necessary part of the program. The expense of acquiring equipment and the time required to carry out an effective sanitation and management program will be offset in a short time by increased gains in weight and prevention of losses from death not only from coccidiosis but from worm parasite infections, white scours, and pneumonia. In the end this will result in greater profits than will depending upon the use of drugs or expecting the veterinarian to bring about a cure after the animal has become sick. When animals are found to have developed the disease, it is advisable to isolate the sick individuals and give them special feed and shelter in order to prevent them from being crowded away from the feed and disturbed by the stronger individuals. This also tends to prevent the spread of the infection to other individuals.

Treatment—Up to the present time there is no known effective treatment for coccidiosis in cattle. It should be remembered that the time of serious symptoms of the disease is so short that any treatment or anything that is done seems to do a lot of good, and as a consequence many preparations have been recommended and sold for use during outbreaks in various domestic animals. It was not until the recent studies of the stages of the life cycle illustrated on Page 33 and the careful observation of the course of the disease that these treatments were found to be of no value insofar as that particular attack of the disease is concerned. This is because the infective stages of the organisms that gain entrance to the digestive tract of the calf develop at the same rate and are ready to emerge from the wall of the intestine at approximately the same time. There is then no recurrence of attacks because the oocysts pass out in the manure and must sporulate outside and then gain entrance to the calf's digestive system in order to produce a new attack of the disease.

This is in contrast to such diseases as malaria, where there is a recurrence of fever and symptoms as a result of development of the malaria parasite within the blood of the infected person.

JOHNE'S DISEASE

A brief discussion of Johne's disease is included in this bulletin because of the similarity between its symptoms and those of parasitism. Johne's disease is caused by a bacterium (not by an animal parasite) which is similar to the organism causing tuberculosis and is named after one of the early students of the disease. These germs attack the wall of the large intestine where they multiply rather slowly and thus it requires months or even years usually for the infection to reach sufficient proportions to cause serious symptoms of the disease. Consequently, symptoms of the disease are not usually observed in animals under two years of age, although positive diagnosis has been made in animals under six months, while symptoms of parasitism very commonly develop in animals under one year of age. There is also a difference to be found in the intestinal wall in some cases. The wall of the large intestine of some animals infected with the organism causing Johne's disease is noticeably thickened, raised into folds, and less elastic than that of animals dead from parasitism and coccidiosis. There is much similarity in the symptoms of the two diseases. Both show emaciation, general weakness, diarrhea, and sometimes a swelling under the jaw and a watery thickening or oedema of the mesentery supporting the digestive organs. A picture of a cow with Johne's disease in the advanced stages is shown on Page 37. There is no treatment for this disease, and death is invariably the result in animals showing severe symptoms.

Johne's disease can be diagnosed by the recently developed johnin test. This should be carried out only by an experienced veterinarian, and the johnin recently developed by the U.S.D.A. Bureau of Animal Industry should be used in the test.

PREVENTION

Management Practices

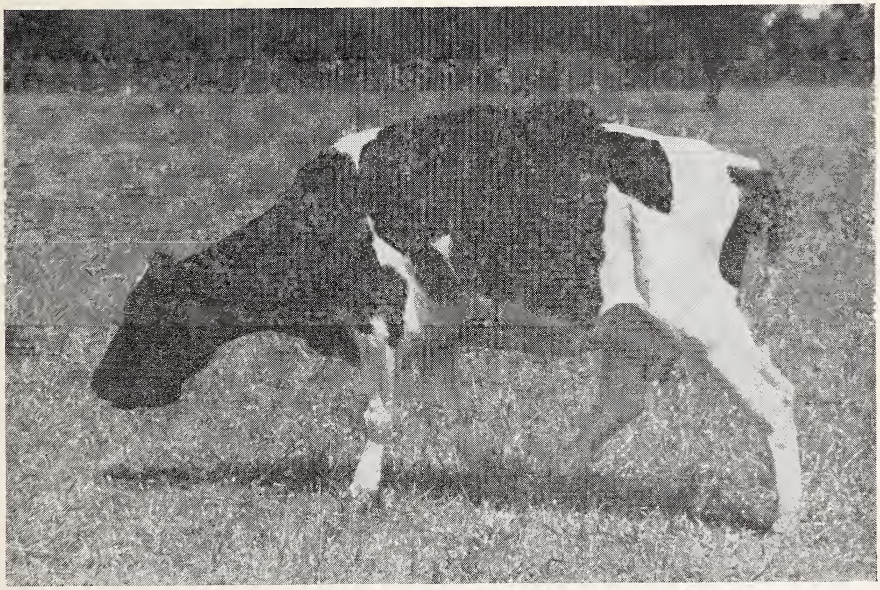
The prevention of losses from parasitic infections is distinctly a problem of management based on the known facts of the life cycle of the species involved. The stages of development in the life cycle may be compared to the links of a chain; and a chain, of course, is no stronger than its weakest link. When the owner has the basic information concerning the life cycle he may be able to adapt some of the details of his scheme of management so that this chain of stages may be broken and severe infections prevented. All dairymen and cattle owners will not be able to put into operation any one complete plan of management, because of the expense involved or peculiarities of individual farms. However, some procedures can ordinarily be put into operation that will reduce the parasite burden and prevent losses.

There are three factors that are of basic importance in influencing the vitality and length of life of the eggs and larvae of internal parasites and the encysted stages of coccidia. These are *temperature, moisture,* and *time.*

Of these, temperature is the one over which we have the least control, but it is nevertheless very important for the successful development of the larval stages. In the states bordering the Gulf of Mexico the larvae have very favorable if not ideal temperatures for development during most of the year. The hot periods in summer combined with less rainfall during some of the months no doubt cause the death of large numbers of larvae. This, however, cannot be relied upon to bring about effective control, because of the shortness of the periods of drought and the carry-over of adult parasites in already infected animals. Neither does the temperature go low enough during the winter months to cause the death of any considerable number of eggs or larvae. Realization of the small part temperature plays in the control of parasites in the Southern states serves to emphasize the importance of undertaking other measures.

Moisture is an essential factor in the life of parasitic eggs and larvae and encysted stages of coccidia and can be controlled in the selection, and by modifying drainage, of pastures and lots occupied by calves and young stock. Barns and shelters also should be so constructed that the floors are as dry as possible.

Time is a factor in the life of parasites because the eggs and larvae are able to withstand the various natural conditions of the environment for a limited time only. Each of the various stages of the life cycle also



Photograph of a cow infected with Johne's disease.

requires definite periods of time. Therefore, it is sometimes possible to modify management so as to prevent or reduce infection.

We may now consider the application of the above factors to management practices.

Drainage—From the standpoint of parasite control, drainage should be of first consideration in the location of lots and pastures, especially those to be occupied by calves and young stock, since they are more susceptible than adult animals. Where natural drainage is not satisfactory, ditches should be dug to remove the excess rainfall quickly. It is not desirable to have water from pastures or lots occupied by older animals drain into or across calf pastures or lots, since eggs and larvae may be washed from one to the other. Barn and shelter floors should be so constructed that they are kept dry. Cement and board floors are the most desirable and dirt, the least. The ground about the entrances should be well drained, but if it is not, a plank or cement entrance platform should be constructed.

Ponds are undesirable as sources of drinking water, because of the continuous presence of a margin of mud through which the animals must wade to drink. Manure is deposited in this mud and the larvae have favorable conditions for development and for gaining entrance to the digestive organs of animals feeding on the grass growing about the margin. The species that penetrate the skin also have favorable conditions for development and an opportunity to come in contact with the skin. Where ponds are utilized as sources of drinking water, it is very desirable to fence them and pipe the water over the side into a trough. A float valve should be put on the pipe to prevent overflow and the development of a mud hole about the trough, otherwise the purpose of the trough will be defeated.

Time—Time can be relied upon to destroy eggs, larvae, and coccidia and can be utilized in pasture rotation, barn sanitation, lot and shade sanitation, etc. Knowing how long it takes for the infective stages of the larvae to develop makes it possible at times to eliminate the source of infection by cleaning at the proper time. Barn, lot, and shade sanitation have not received the emphasis they deserve in the past, but since we know now that infection with certain species occurs through the skin, attention should be directed to this phase of control.

Barn sanitation involves cleaning the barn at regular intervals, preferably once a week, but certainly as often as possible, in order to prevent the accumulation of developing larvae. Where animals are showing symptoms of parasitism, weekly cleaning should be carried out in order to prevent the infection from reaching greater proportions. Weekly cleaning is important, because, as pointed out in the discussion of the various species and in the life cycle diagrams, the larvae hatch and develop to the infective stage in about a week or a little less. Thus by weekly cleaning, the eggs and the larvae are removed before they reach the infective stage. Care should be taken to remove all the manure from the corners, etc.; otherwise, the purpose of cleaning will be defeated. Water should not be used unless the floor is so constructed that it will drain and dry quickly.

Bedding is desirable but it is always necessary to keep in mind the conditions under which it is used. If cleaning is not carried out regularly and thoroughly, bedding tends to hold moisture and otherwise protect the eggs and developing larvae. In this connection it is well to consider possibilities of introducing parasitic larvae and coccidia from outside sources. If calves are confined to stalls, larvae may be introduced on the shoes or boots of the attendant if it is necessary to enter the stall to feed the animals. If the calves have access to a yard or pen in which a mild infection exists, they will infect the bedding by carrying it on their feet. If hay is used for bedding it should be cut from land that has not been grazed and especially not by young stock known to have been infected, because in recent experiments it has been shown that the larvae of some species remain infective at least a year on hay. These precautions are especially important in preventing the development of coccidiosis but also apply equally to other parasites and to bacterial infections.

Isolation of calves in separate stalls is the most desirable method to follow in controlling all diseases, but this may not be economical except where the animals are valuable. By this method infection does not spread so rapidly from individual to individual and thus does not reach epidemic proportions. Another method used extensively in the tropics and recommended for control of coccidiosis by workers at the Regional Animal Disease Research Laboratory at Auburn, Alabama, is segregation by age groups. Animals are separated according to age and never allowed to mingle with the individuals of the older or younger groups. The following groups are suggested: (1) under 3 weeks, (2) 3-6 weeks, (3) 6 weeks to 3 months, and (4) animals over 3 months. In this system when the oldest calves reach maximum age for that group, each group is moved to the quarters of the next highest age group, which leaves the quarters of the youngest group empty to accommodate the animals to be born during the next three weeks. The advantage of this system is that the younger animals, which are more susceptible to parasite damage, are not exposed to the heavier infections of older animals in which there has been more time for large numbers of parasites to build up. Another advantage is that if an infection gets established in one group the animals of the others are not exposed. *It should be kept in mind, however, that utilization of a segregation plan does not eliminate the necessity of a system of thorough cleaning at regular intervals in order to remove any organisms that may get into the quarters.* One of the cleaning times should, of course, fall on the date when the calves are changed into the quarters of the next higher age group.

Another method recommended by the Regional Animal Disease Research Laboratory at Auburn, Alabama, is the use of portable pens. These are in use at the laboratory for raising animals for their experiments and by many dairymen over the states of Alabama, Georgia, and Mississippi. The pens are made about four feet by eight feet out of light material, usually a wooden frame covered with woven fence wire. One end is closed in on the sides and top to protect the calf from bad weather. The pens are set at first preferably on the low side of sloping ground and moved up the slope to clean ground once a week. By the selection of sloping ground, any infection which may have gotten a start cannot be washed onto the areas to be used at later dates. Even though the pens are quite open and the animals are exposed to the weather, it is claimed that pneumonia and other diseases are practically eliminated because of the lack of accumulation of the disease-producing organisms as compared with tightly closed quarters of barns and sheds. Detailed information as to construction and use of these pens can be secured by writing to the Animal Disease Research Laboratory at Auburn.

Pasture—Since parasitic infection takes place readily by mouth the pasture must be given serious consideration in the problems of control. The problems are also likely to increase when pasture improvement is undertaken, for with improvement comes greater and better grass production which will feed more animals, and increasing the cattle production always increases the probability of a greater parasite population. One answer is pasture rotation, especially for young animals. This may be carried out by plowing under the infected topsoil and grass and planting another crop for one or two years before reseeding and using for grazing again. Another alternative is to use the old pasture for meadow and thus give time for the forces of nature to kill the eggs and larvae. Rotation assumes that other ground is available in a suitable location for pasture, but if such is not the case, the pasture may be plowed in the fall and planted to oats, winter grass, or some crop that can be quickly utilized for grazing. This turns under the infected topsoil and grass to a large extent, and fresh, uncontaminated grazing plants are quickly made available. This plan is especially applicable if the original sod is Bermuda, which will quickly resod the following season. Mowing pastures also probably helps to some extent in controlling parasites, since the taller growth is cut and animals feed on the newer growth which has had less time to become contaminated with larvae. Harrowing or dragging infested pastures possibly aids also in the destruction of larvae in that piles of manure are scattered and dry faster and thus less protection is offered to the developing larvae. Another plan of rotation of possible value is to use the pasture grazed by older stock or a portion of it for the young and more susceptible animals. The basis for this is that adult animals, on the average, have a very much smaller number of parasites than young stock; consequently, the infection on their pasture would ordinarily be much less. Cattle manure from the barn should not be scattered on the pasture grazed by young stock because of the danger of introducing eggs and larvae and thus increasing the infection or adding additional species not already there.

It should be pointed out again that pasture sanitation alone cannot be relied upon to control parasites; the barns and shade are equally important. In some instances heavy infections develop in animals too young to have eaten large quantities of grass or hay and receive their feed mostly in the form of milk and concentrates. In addition to barns the other places where calves lie down should receive attention because of the skin penetrating species and because calves are constantly licking their coat and may in this manner acquire larvae that have gotten on the hair. Where calves are known to be infected, it would be advisable to remove the accumulations of manure from the shade areas at four- or five-day intervals.

Treatment is important in reducing pasture infection and in the general plan of control. Removing the adult worms by an effective anthelmintic reduces the number of eggs deposited in the manure and thus reduces the number of larvae which may be picked up by the animals. Animals known to be heavily infected should be treated a week or so before being transferred to a clean pasture in order to avoid its immediate contamination. In other instances where animals are being transferred to clean quarters or pastures or lots recently plowed, the transfer should be made after treatment in order to avoid contamination of the clean ground.

Low Level Feeding of Phenothiazine as a Means of Prevention

Recent experiments carried out at the Agricultural Experiment Station at Louisiana State University show that continuous feeding of small amounts of phenothiazine should be extremely useful in preventing the build-up of infections and in the reduction of high infections on badly contaminated premises. It has been found that ½ to 1½ grams of the drug is effective in eliminating the infective larvae of the hookworm and in stopping egg production of the nodular worm. Observations made to date show that there is probably no effect on the eggs or larvae of the group of small worms (*Cooperia, Ostertagia, Trichostrongylus, Nematodirus*) found in the fourth stomach and small intestine. Thus, since the drug stops the supply of infective larvae of the above named species outside the calf, reinfection is reduced and younger animals are protected from infection. Experiments indicate that phenothiazine fed in this manner has no effect on the infective larvae after they get into the calf, since severe symptoms and death have occurred within eight days after inoculation with the nodular worm larvae. Experiments have not been carried out to determine the effect on the larvae of other species during the larval period within the calf. No evidence had been found to indicate that there is any beneficial effect on the animals already infected or that an outbreak of acute symptoms will be stopped. The benefits to be expected are in the protection of the next generation of calves and the reduction of reinfection due to the elimination of infective larvae about the lots and barn.

In feeding the drug the owner must determine the number of pounds of grain mixture he is feeding per day to each calf and add 1½ grams of phenothiazine to this amount. Since a pound contains 453 grams, one pound of the drug would last one calf 300 days or about 10 months. If 10 calves are being fed, one pound should be sufficient for those 10 calves for 30 days. If the animals are of such an age that they are being fed five pounds a day, 50 pounds of feed would be consumed per day and 1,500 pounds in 30 days, so 1½ pounds of phenothiazine should be added to one month's supply of grain. In this manner the owner can determine the amount necessary to add to the feed in order to obtain the expected results. The above figures are on the basis of the avoirdupois pound of 16 ounces and not the apothecaries' pound of 12 ounces.

The following table will be of assistance in making up the feed mixtures:

No. lbs. feed per day	Lbs. Pheno. per 100 lbs. feed	Lbs. Pheno. per 1,000 lbs. feed	Ozs. Pheno. per 100 lbs. feed
2	0.165	1.6	2.64
3	0.111	1.1	1.76
4	0.083	0.83	1.33
5	0.066	0.66	1.06

Ordinarily it will be more convenient to have the phenothiazine weighed out in the proper amount at the time of purchase.

It should be pointed out that continuous feeding of the drug is necessary since it is effective in protecting animals against infection by the hookworm only while it is being fed, because it does not affect the eggs but does prevent the development of infective larvae. Continuous feeding is necessary to control the nodular worm, because eggs that are capable of producing infective larvae reappear in the manure of infected animals after one to three months. Continuous feeding should be carried out for 10 to 12 months in order to stop the contamination of the premises and allow time for the larvae already on the premises to die out. Our experiments indicate that the cost of accurately carrying out this method of feeding the drug will be small when compared to the losses should a future outbreak of worm infection occur.

TREATMENT

Treatments of various sorts have long been recommended for the removal of the adult parasites of domestic animals and man. Anthelmintics, which are drugs used for removal of parasites, are selective to a considerable degree in their action on different parasites; therefore, information as to the species with which animals are infected is useful in the choice of the drug to be used. The use of these drugs or chemicals is based upon the principle that they are more toxic or poisonous to the parasite than to the host animal to which they are administered. Some are more toxic or poisonous to the host animal than others and therefore must be given in reduced amounts if the animal is in poor condition. The amount administered must also be adjusted according to age and size of the animal. In weakened animals it is often advisable to reduce the dosage according to their condition and repeat the treatment in about two weeks. At the same time it is strongly recommended that special care and good feed be given those individuals showing the effects of parasitism in order to build up their general resistance to other diseases. The efficiency of the drug is affected by the fact that it is at once diluted by the contents of the digestive tract as well as acted upon by the various substances in the contents, with the result that it is rendered less effective. Consequently, a substance that is insoluble is not absorbed or changed chemically by the contents of the digestive organs, and thus is more desirable provided it is poisonous to the parasite. An insoluble drug is particularly advantageous in treatments for the removal of those species in the posterior portion of the digestive system, such as the nodular worm. Drugs that are not absorbed are in general less toxic to the animal being treated than are those readily taken up by the blood stream.

Phenothiazine

Because of its high efficiency against most of the species and because of its low toxicity, phenothiazine is the most satisfactory drug in use at the present time for the removal of adult parasites from cattle. It has been found to be very efficient against the large stomach worm, the nodular worm, and *Trichostrongylus* sp., but not so efficient against *Cooperia, Ostertagia,* and the hookworm. Some experiments indicate that it is possibly more effective against the hookworm in larger than recommended doses. It is relatively safe to administer since when given to experimental animals in quantities of two and three times the large dose of 20 grams to 100 pounds body weight recommended by some, no ill effects were observed. Experiments indicate it is not necessary to keep the animals off feed before giving the drug in order to secure the best results.

Even though the administration of this drug is relatively safe, it is desirable to secure the services of an experienced veterinarian for the job, especially if the animals are valuable or if the number to be treated is large. However, this is not economical in many instances; in such cases it is well to consult a veterinarian and secure the necessary quantities of the drug, instruments for its administration, and advice as to dosage, restraint, etc. *While the preparations sold by the various manufacturers are similar in most details, it cannot be emphasized too strongly that the directions on the label should be carefully studied and closely followed in order to avoid unfavorable results.*

Administration—The most desirable method of administering any treatment is to each individual animal rather than to the group or herd. This insures that each animal receives an accurate amount of the drug and permits adjustment of the dose according to the size and physical condition of the animal. If the group is allowed access to feed to which the drug has been added, the greediest and healthiest individuals will eat faster and crowd other individuals to one side, and thus the animals that may really need the treatment the least, secure the most of the drug. The tastes of individual animals also vary and some will reject such drug feed mixtures, thus allowing other animals to eat more than their share. The best results are obtained only by individual treatment unless there are reasons that make individual handling of the animals impractical.

Phenothiazine is supplied by a number of companies furnishing veterinary supplies and may be obtained in the form of a liquid suspension, in capsules, tablets, and in powder form. The liquid suspension is designed as a drench, but because of the danger of getting the material into the trachea, it is not advisable to give it from a bottle, but by means of a metal dose syringe. These are usually made in two sizes, 2-ounce and 4-ounce capacity, so that the quantity to be given may be measured. They are provided with a metal tube of sufficient length so that when the tube is inserted into the mouth, the drug is deposited back of the base of the tongue in a position to be easily swallowed. The animal should be securely held and the nose raised a little higher than the back of the head in a position so that swallowing is not interfered with. The capsules are designed to be administered with the aid of a balling gun, which places the drug back of the base of the tongue in a position to be swallowed. Care should be taken not to get it in a position to pass into the trachea.

The powder can be packed in the standard veterinary gelatine capsules or mixed with the feed. In case it is mixed with the feed the animals should be fed individually if at all possible. Should group treatment be decided upon, it is highly desirable to divide the animals according to size and condition and allow the groups access to the feed separately.

Dosage—The amount of phenothiazine recommended as a dose for cattle varies between 10 and 20 grams per 100 pounds of body weight, with a maximum dose of 60 to 75 grams for grown animals. An apothecaries' ounce is equivalent to 31 grams. Dr. P. D. Harwood, who discovered the effectiveness of phenothiazine while in the U.S.D.A. Bureau of Animal Industry, recommends its administration at the rate of 10 grams per 100 pounds of body weight, with a maximum dose of 60 to 75 grams. Dr. D. A. Porter of the Regional Animal Disease Research Laboratory at Auburn, Alabama, recommends 20 grams to each 100 pounds of body weight, with a maximum dose of 60 grams. Since there is so much variation in the size of individuals of the same breed as well as different breeds, it would seem advisable to administer the drug according to weight rather than age in order to secure the greatest efficiency, safety, and economy.

In case the liquid suspension, capsules, or tablets are obtained it is wise to follow the manufacturer's recommendations as to dosage, because products vary as to the actual amount of the drug they contain. If the powder form is obtained it is necessary to measure it in some way in order to get the proper dosage. A Number 10, or one-ounce, standard veterinary gelatin capsule will hold from 20 to 22 grams of the powder when it is thoroughly packed in and pressed down with the thumb. When it is not so thoroughly packed it will contain about 16 to 20 grams depending upon the degree of packing. On this basis one thoroughly packed Number 10 capsule is approximately the maximum recommended dose per 100 pounds of body weight. A Number 11, or ½-ounce, gelatin capsule will hold, when thoroughly packed and pressed with the thumb, 9½ to 10 grams and as little as seven grams when not thoroughly packed. Hence, two Number 10 and one Number 11 capsules thoroughly packed would be approximately the maximum recommended dose for a 250-pound calf. In case the powder is to be mixed with the feed it can be measured by tablespoonfuls. Since there is much variation in the size of ordinary tablespoons, it is advisable to use one of the tablespoon measures used in the kitchen. A packed level tablespoon measure will hold between nine and 10 grams of the powder when well packed and scraped off even across the top; when not well packed it may hold as little as seven grams. Hence two well-packed level tablespoon measures would be approximately the maximum dose per 100 pounds body weight. Some veterinarians, as a result of their experience with the drug, recommend as low as 10 grams per 100 pounds body weight and adjust the dose to the condition of the animal.

Toxic Reactions—Toxic reactions to phenothiazine are not common, and those that do occur usually are of little consequence. However, recently treated animals should be watched in order to detect any individuals that do not respond favorably. Sometimes the eyes become sensitive to bright light and temporary blindness results. Animals so affected should be confined to a darkened stable or dense shade until recovery. Constipation may follow in animals to which large doses have been given, and to these a cathartic should be given if necessary, although recovery usually follows spontaneously. Occasionally animals will be off feed and will be unsteady in movement for a day or so but quickly recover. The urine may be colored red for a few days owing to the excretion of the chemical, but this is no cause for alarm.

Copper Sulphate and Copper Sulphate-Nicotine Sulphate

Copper sulphate, or bluestone, has long been recommended as an anthelmintic for cattle, sheep, and goats. It is not, however, considered very effective against any of the species parasitic in the digestive tract of these animals except the large stomach worm. Since recent experiments have shown that the large stomach worm is much less serious in its effect on cattle than formerly supposed, the arguments in favor of the use of this treatment have less weight. However, it is recommended and used by some. The strength usually used is a one per cent solution in water. This is made by dissolving one-half pound of the blue crystals of copper sulphate in one pint of boiling water and then adding enough water to make three gallons of solution. Porcelain, earthenware, or glass containers should be used in the preparation and storage of the solution as it will corrode metal. The dose recommended is as follows: calves, 3.5 to 4 ounces; yearlings, 6 to 8 ounces; two years old and over, 16 ounces to one quart. A Coca-Cola bottle holds seven ounces when full, is easily obtained, and is properly shaped for a good drench bottle. Many prefer the addition of one ounce of 40 per cent nicotine sulphate (Black Leaf 40) to each gallon of the one per cent solution of copper sulphate and believe it is more effective. The dosage is the same as for the copper sulphate solution. Animals are susceptible to poisoning with both of these preparations, and animals in poor condition should have the dose reduced carefully according to their condition and size. Severe poisoning and death are not uncommon if the amount given to the animals in good condition is excessive. Animals in a weakened condition should not be given more than one-third the recommended dosage.

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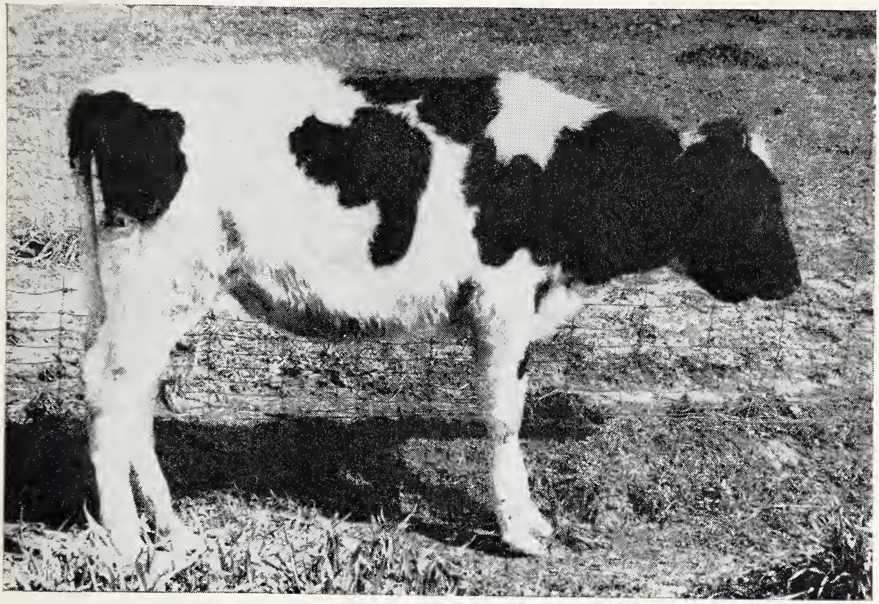
The Parasites and Parasitic Diseases of Cattle

Roy L. Mayhew



Calf showing advanced stages of chronic parasitism. Note the rough coat and the general depressed condition. The swelling under the jaw, so evident in this animal, develops in some cases only.

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Louisiana State University
and
Agricultural and Mechanical College
Agricultural Experiment Station
Charles W. Upp, Director

CATTLE FOR PARASITES OR PROFITS?

Losses from parasites of the digestive organs, liver flukes, lungworms, and coccidia cost the livestock owner a very large sum of money annually in deaths, loss of flesh, stunted growth, extra care, etc.

It is fundamental in the problem of control of parasites to keep in mind that there is a part of the life of the parasites inside and a part outside of the cow or calf. The part inside consists of larval development and the adult. The larvae, for which at present there is no treatment, cause the acute symptoms and the most serious damage. The acute stage of the infection passes into the chronic with the maturing of the larvae into adults. The adults of some species can be more or less effectively removed by appropriate treatment. The part of the cycle outside consists of larval stages which have hatched from the eggs passed in the manure. These develop into the infective stage, which must gain access to the digestive tract in order to develop further. It is at this point that it is possible to apply control measures through management.

Prevention of losses from parasitism is a problem of proper herd management based on the life cycles of the species involved. The following practices will serve to keep parasitic infections at a low level:

1. Sanitation in all phases, especially the weekly or frequent removal of manure from barns, sheds, and shade areas, is a most important step.

2. Good drainage in pastures and lots leads to the destruction of the larval stages of all parasites. Dryness is especially important in the barn sanitation program.

3. Pasture rotation, practiced where, and as often as, possible, will aid in the reduction of infections.

4. Feeding of phenothiazine in the grain ration at the rate of 1½ grams per day is effective in reducing the number of larvae of the hookworm, nodular worm, stomach worm, *Cooperia punctata,* and *Trichostrongylus axei* about the premises, thus reducing infections in the next generation of animals.

5. Treatment of animals at regular intervals two or three times a year tends to eliminate the adults and hence reduces the number of larvae that produce new infections.

Consult a veterinarian in regard to a parasite control program for your farm.

The expenses of good management practices will be offset in the raising of more and healthier animals that produce more meat and milk. *Management is much more effective in parasite control than drugs.*

TABLE OF CONTENTS

Page

Introduction ... 4
The Rumen Fluke ... 8
Parasites of the Fourth Stomach ... 8
  The Large Stomach Worm ... 8
  Small Thread-Like Stomach Worms ... 12
Parasites of the Small Intestine ... 13
  The Hookworm ... 13
  The Cooperias ... 15
  Trichostrongylus colubriformis ... 16
  The Ascarid ... 16
  Thread-Necked Worms ... 17
  Strongyloides papillosus ... 17
Roundworms of the Abdominal Cavity ... 18
Parasites of the Large Intestine ... 18
  The Nodular Worm ... 18
  The Whipworm ... 21
Tapeworms ... 21
  Adult Forms ... 21
  Larval Forms ... 22
Lungworms ... 24
Liver Flukes ... 27
  Common Liver Flukes ... 27
  The Lancet Fluke ... 32
  Fascioloides magna ... 33
Coccidia and Coccidiosis ... 33
Johne's Disease ... 37
Immunity to Parasitic Infections ... 38
The Importance of Diagnosis ... 39
Prevention ... 40
  Management Practices ... 40
  Low Level Feeding of Phenothiazine ... 44
Treatment ... 46
  Phenothiazine ... 46
  Copper Sulphate and Copper Sulphate-Nicotine Sulphate ... 50
  New Anthelmintics ... 50

The Parasites and Parasitic Diseases of Cattle

ROY L. MAYHEW[1]

INTRODUCTION

Cattle, as all domestic animals, are affected by numerous species of internal and external parasites. Among the internal parasites, twenty-six species of roundworms, four species of flukes, five species of adult and larval tapeworms, twenty-four species of protozoa, and an additional miscellaneous group of seven species, including the lungworm and abdominal worm, are reported as occurring in the digestive organs. Many of these species do not have a wide distribution or cause serious damage and therefore are not included in the following pages. Of the external parasites at least twenty-seven species of ticks, lice, mites, and flies have been reported as infesting cattle. Since the external parasites are on the outside surfaces of the animals their presence is easily detected and methods for their control are fairly easily and safely carried out. The methods for their control and eradication are also more generally known than for the internal parasites. It is for these reasons that a discussion of external parasites is not included in this bulletin, but an effort has been made to include information regarding all species of internal parasites that cause disturbances of digestion and the accompanying disorders. Brief mention is made of Johne's disease because it can be, and sometimes is, confused with parasitism.

The symptoms produced by the various species of parasites of cattle have many similarities and may be divided into acute and chronic stages.

A diagram based on the results of experiments at the Louisiana Experiment Station showing the relationship of the periods in the life of parasites to the effects on calves is shown in Figure 1. In the upper portion of this diagram are indicated the events that take place inside the calf or cow, and in the lower portion those that occur outside. It is necessary for all of these steps to take place and they must occur in this order. There is no intermediate host necessary in the case of the roundworm parasites of cattle such as occur in the case of the flukes. Neither is there any multiplication of the parasites within the calf or cow as is the case in the bacterial diseases. As a result of this the severity of the disease is dependent upon the number of infective larvae gaining access to the susceptible animal. The larvae that hatch from

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[1] The information contained in this bulletin has been compiled from many sources. An attempt has been made to give proper credit to the many research workers who have supplied details of life histories, anthelmintics, etc., etc. Much information has been included which is the result of the author's studies of cattle parasites. The author wishes to express his appreciation to the many persons who have read the manuscript and for their many suggestions and for the information they have contributed.

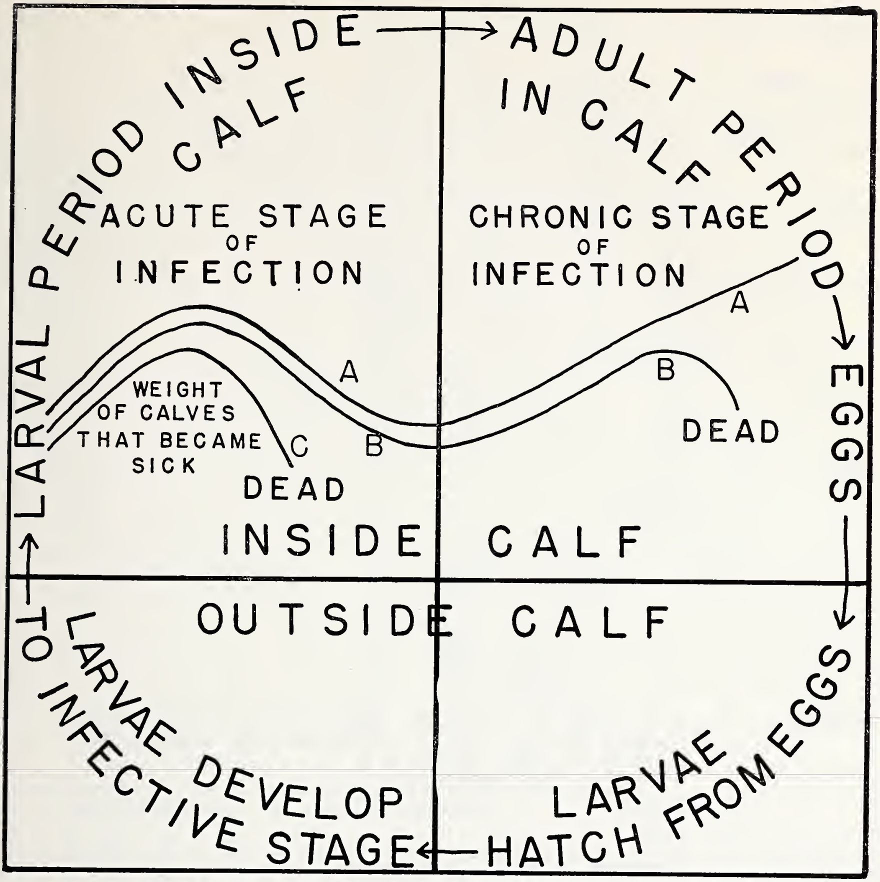

FIGURE 1.—Relationship of the periods in the life of parasites to the effects on calves.

the eggs that are laid in the manure by the adult worms develop to the infective stage and gain entrance to the digestive system through the mouth and/or skin, depending on the species. In the digestive system they undergo a series of changes, in the progress of which they become adult worms. The time required for these developmental stages between infection and the production of eggs is called the prepatent period. Experiments have shown that very severe symptoms are produced by these larvae during this time due to their penetrating the intestinal wall and otherwise causing a general interruption of the normal digestive processes. The diarrhea, loss in weight, and lack of appetite which constitute the acute symptoms of the disease develop during this period and are much more severe than any damage that has been observed during the period of the adult worms. The symptoms observed during the adult period are a continuation of those started during the larval period and, therefore, this is called the chronic stage of the infection.

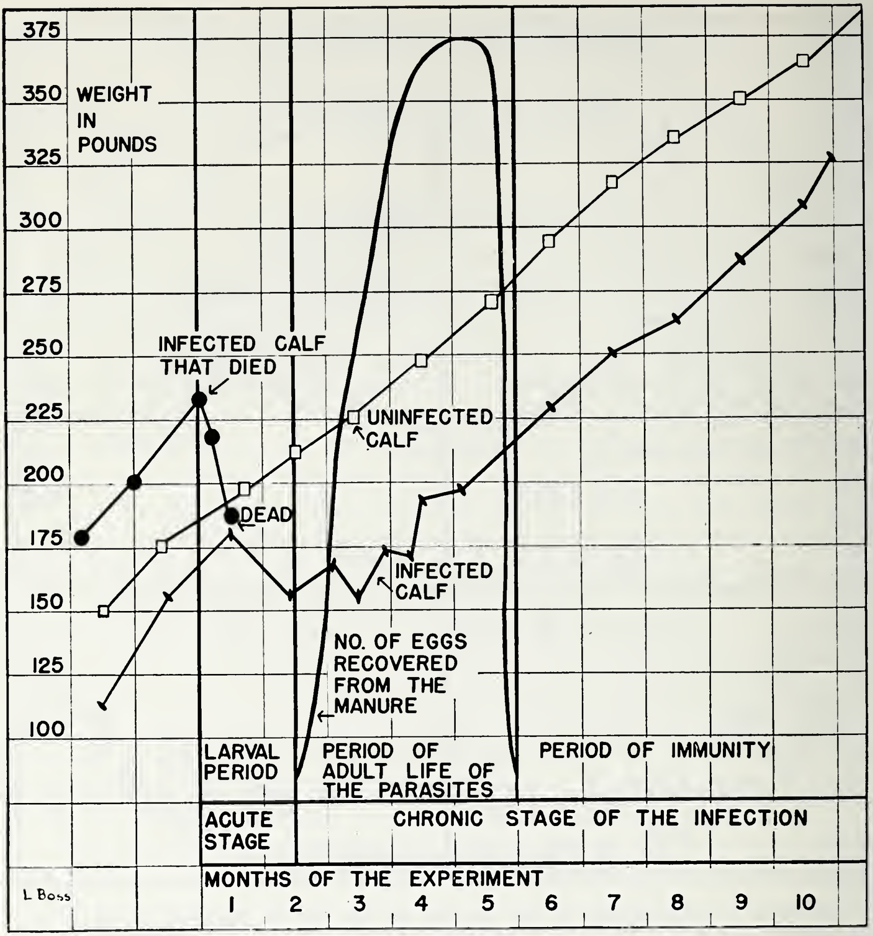

FIGURE 2.—Relationship of the periods in the life of parasites to the effects on calves.

Table 1 contains a summary of the important facts in the life cycle of the various species.

An attempt is made to show diagramatically in Figures 1 and 2 the weights of animals that become sick. Line A in Figure 1 shows the course of the gain or loss in weight of an animal that survived the disease. His weight and general condition remain below normal for a long period, but in the course of months or a year or more, he gradually recovers from the damage caused by the larvae. Line B (Figure 1) represents the weight gains of an animal that makes considerable gain during the chronic stage but, when unfavorable conditions come along, is not able to muster enough reserve strength to survive. Such an animal has a good appetite and improves more or less in weight and general condition, but when the pasture becomes short and unfavorable winter weather comes along, he gets down and sooner or later death results.

Table 1. Important Information Concerning the Species of Cattle Parasites

Common Name	Scientific Name	Location in Host	Manner of Infection	Location of Larvae	Range of Prepatent Period ∿∿∿∿∿∿∿∿∿∿ Days (Days between infection & egg production) Range of Beginning of Symptoms ●●●●●●●●●● Days No. Days After Infection 0 10 20 30 40 50 60 70
Large Stomach Worms	*Haemonchus contortus* & *placei*	4th Stomach	Mouth	4th Stomach	14∿∿∿∿∿∿∿∿29 Symptoms only very slight
Medium Stomach Worms	*Ostertagia ostertagi*	4th Stomach	Mouth	4th Stomach	Deaths as early as 23rd day Eggs at about 21 days.
Small Hair Worms	*Trichostrongylus axei*	4th Stomach	Mouth	4th Stomach	1●●●●10 19∿∿∿∿∿∿∿30
	Trichostrongylus colubriformis	Small Intestine	Mouth	Small Intestine	15∿∿∿∿23 Deaths in 21 to 31 days.
Hookworm	*Bunostomum phlebotomum*	Ant. 15 ft. Sm. Int.	**Skin** Mouth	Ant. ½ Sm. Int.	31 ●●●●●●45 52∿∿∿∿∿∿∿∿∿68
Thread Worm	*Strongyloides papillosus*	Sm. Int.	**Skin** Mouth	Ant. Sm. Int. Lungs	9∿∿∿15 7●●●14 Deaths 11-14 days in sheep
Large Round Worm	*Neoascaris vitulorum*	Sm. Int.	Prenatal (Mouth?)	Unknown	Unknown
Small Intestinal Worm	*Cooperia punctata*	Sm. Int.	Mouth	Ant. ½ Sm. Int.	8∿∿∿∿∿17 5●9
Thread Necked Worms	*Nematodirus helvetianus*	Sm. Int.	Mouth	Sm. Int.	21∿26 Symptoms as early as 15th day
Capillarids	*Capillaria* 2 species	Sm. Int.	Unknown	Unknown	Unknown
Nodular Worm	*Oesophagostomum radiatum*	Caecum Colon	Skin **Mouth**	Post. ½ Sm. Int. & L. Int.	33∿∿∿∿∿∿44 Symptoms as early as 4th day, death 8th
Whip Worms	*Trichuris* (2 species)	Caecum	Unknown	Unknown	Unknown

(See picture on front cover.) Line C (Figure 1) represents the weight gains of an animal that becomes very severely affected, loses weight rapidly, and dies during the acute stage of the disease. Figure 2 shows the course of the disease with reference to weights and egg counts.

The economic losses from parasites may be said to be due to deaths resulting from severe infection and from loss in weight and the general condition of recovered animals. There is also the extra expense of special care, feed, and treatment of those animals showing symptoms. There is no way of determining the total economic loss from parasitic diseases of cattle of all ages, but it is certainly a large sum.

THE RUMEN FLUKE

One fluke (*Cotylophoron cotylophorum*) is found in the rumen or paunch and in small numbers in the reticulum or honeycomb (second stomach) of cattle. These parasites are small worms somewhat conical in shape and convex on the top or dorsal side. They are about one-fourth inch in length and reddish in color when alive.

Life Cycle—The life cycle is similar to that of other species of flukes in that a snail is required as an intermediate host. The eggs are passed in the manure, and small larvae hatch from the eggs in from 11 to 29 days, depending on the temperature. The snail (*Fossaria parva*) rarely exceeds one-fourth of an inch in length and is commonly found along the margin of open ponds and streams where moisture and decaying vegetation are present and where there is no shade. The larval forms that hatch from the eggs are called miracidia. They enter the body of the snail and there develop through a succession of stages into the infective stage. The time required for development within the snail varies from 30 to 91 days, according to the temperature. These larvae encyst on grass in the pasture and thus are taken into the digestive organs of cattle during grazing. They first pass to the duodenum or front portion of the small intestine where they remain from three to five weeks. From the duodenum they migrate forward to the rumen where they complete their development. The time required for the development of the larvae to adult worms in the calf is about four months. The total time required for the life cycle is from five to eight months, depending on the temperature.

Symptoms—In heavy infections in South Africa it is said that severe inflammation is produced by the young stages in the duodenum, which results in diarrhea. The adults are not believed to cause any damage. In the United States, losses from this parasite have not been reported.

PARASITES OF THE FOURTH STOMACH

The Large Stomach Worm

In the past these parasites have been considered as belonging to one species, *Haemonchus contortus*. Recently some consider that there are two species infecting cattle, sheep, and goats, *H. contortus* being more common in sheep and goats and *H. placei* the more common species

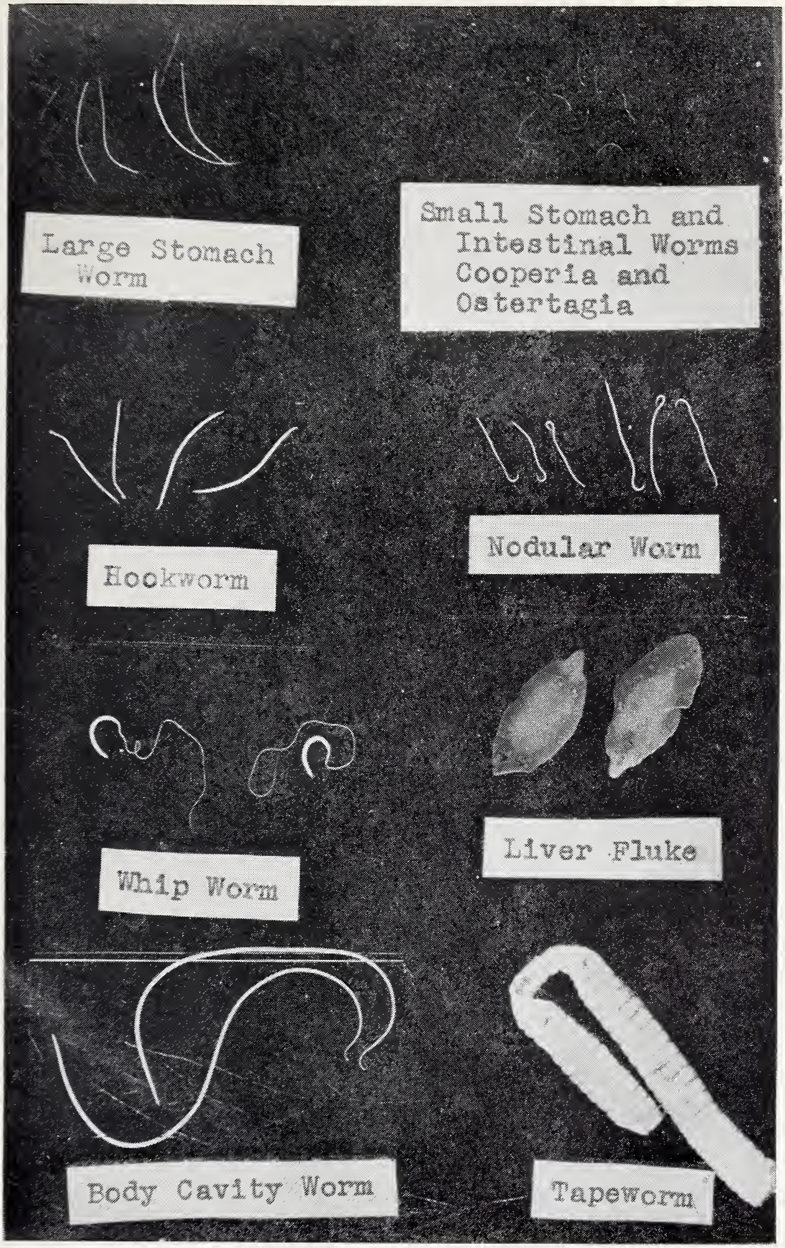

FIGURE 3.—Photograph of the most common parasites of cattle, actual size.

in cattle. A third species, *H. similis,* has been reported in cattle in the gulf coast states.

The large stomach worm is often present in large numbers along the walls and folds of the fourth stomach or abomasum of cattle, sheep, and goats. These parasites are three-fourths to one and one-half inches in length, of sufficient diameter to be easily seen, and, particularly the larger specimens, are marked with a spiral red stripe which has led to their sometimes being called the twisted wire worm. Figure 3 shows this species in relation to the other important parasites of cattle.

Life Cycle—The eggs are deposited by the adult females in the contents of the fourth stomach of the calf and pass out in the manure. Small larvae hatch from these eggs in from 18 to 24 hours. A diagram showing the stages in the life cycle is shown in Figure 4. The newly hatched larvae require about five days in which to develop so they can produce infection in another calf. This stage is recognized under the microscope by the presence of a thin, transparent outer covering or sheath which offers some protection against being killed by drying out or too low or too high temperatures. Infection is by way of the mouth. Upon reaching the fourth stomach, the larvae complete their development into adults in from two to four weeks, most of them requiring about four weeks. That the adults will live and produce eggs for as long as 14 months in calves under conditions in which reinfection does not take place has been shown in our experiments. The length of life of the larvae under the various soil, weather, and grass conditions is not known but probably varies greatly under the different combinations of conditions in the pasture.

Symptoms—Calves have been found to gain little or lose weight, and a more or less severe anemia develops during the larval period. The adults are bloodsuckers, having mouth parts for piercing the tissues, and in this manner they no doubt contribute to the unthrifty condition of infected animals. This parasite has not been found to cause as much damage as other species.

Immunity—Experiments at the Louisiana Agricultural Experiment Station have shown that an immunity or resistance to infection with the large stomach worm is developed by inoculation with pure cultures of the infective larvae. Infection takes place as a result of the first inoculations, then with additional or sometimes without additional inoculations the number of adult worms that have become established is suddenly reduced sharply and abruptly, as indicated by the number of eggs recovered from the manure. Subsequent inoculations failed to establish any large number of adults or produce any symptoms of parasitic infection. Attempts to establish this immunity previous to the initial inoculations by the injection of extracts of adult worms or powdered whole worms have thus far failed to produce any protection from infection. Apparently this immunity is permanent when it is once established, because when some of these animals were placed in a heavily contaminated pasture the infection remained at a very low

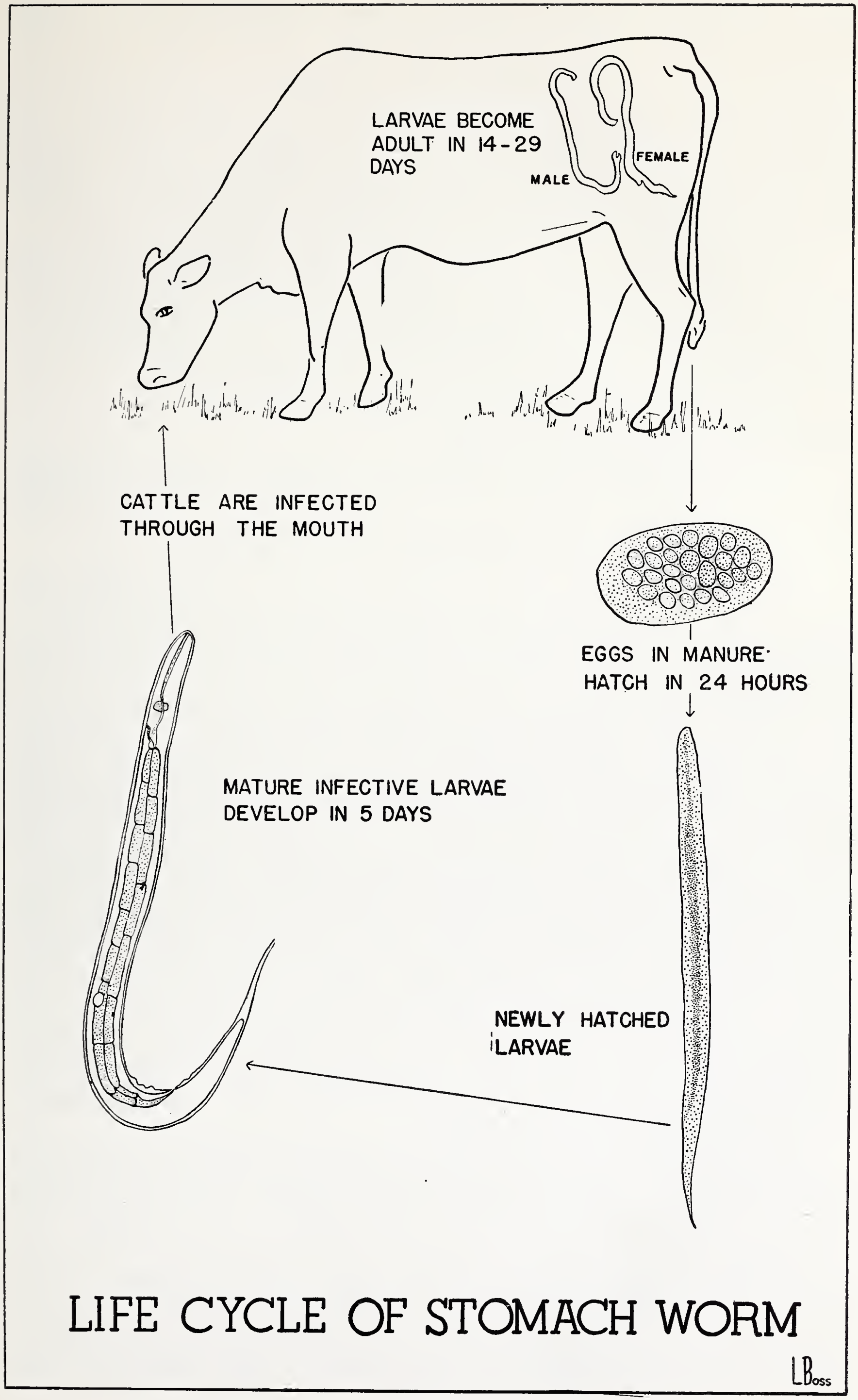
LARVAE BECOME ADULT IN 14-29 DAYS
FEMALE
MALE
CATTLE ARE INFECTED THROUGH THE MOUTH
EGGS IN MANURE HATCH IN 24 HOURS
MATURE INFECTIVE LARVAE DEVELOP IN 5 DAYS
NEWLY HATCHED LARVAE
LIFE CYCLE OF STOMACH WORM
LBoss

FIGURE 4.

level, as evidenced by the number of eggs recovered from the manure and by the general physical condition of the animals. It was possible to follow some of these animals until they were six years old. Poor feeding during the winter months had no influence on the immunity, since there was no increase in the level of the infection. Neither was it possible to break down the immunity by lowering the plane of nutrition to a very low level by a ration of only cottonseed hulls. Animals fed cottonseed hulls until they showed definite emaciation, even almost to the point of death, did not become reinfected when reinoculated.

Treatment—The copper sulphate and copper sulphate-nicotine sulphate solutions discussed in the section on treatment have long been used for the removal of the large stomach worm. Phenothiazine has recently been found to be very effective also, and for a discussion of its use the reader is referred to the section on general treatment.

Small Thread-Like Stomach Worms

The small stomach worms belong to two genera, namely *Ostertagia* and *Trichostrongylus,* and are very much smaller in size than the large stomach worm. Figure 3 shows some of these small worms in comparison with other species.

Two species of the genus *Trichostrongylus* are found in calves, *T. axei* in the fourth stomach and *T. colubriformis* in the small intestine. Some comments on the latter are to be found in the section on parasites of the small intestine.

Trichostrongylus axei occurs in sheep, goats, and horses as well as cattle. These small worms are one-fourth to one-half inch in length and very slender; consequently, they are very easily overlooked at postmortem examinations. If present in large numbers they can sometimes be detected as tiny thread-like objects if the folds of the stomach are lifted slowly. The most successful way to recover them, however, is to wash the contents of the stomach and mucus rinsed from the walls into a bucket or garbage can holding three or four gallons of water. After allowing the sediment to settle 10 to 15 minutes, pour off almost all the water, fill the can, and again allow to settle, repeating the process until the water stays nearly clear. Some of the contents may then be examined in a glass jar or dish, preferably against a dark background. Generally these worms, if present in large numbers and if the calf has not been dead too long, will have a distinct reddish color when thus cleared of the sediment.

Life Cycle—The larvae of these worms are believed to become infective in about a week and to develop to the adult stage in the calf in from 19 to 30 days after infection, and the adults can live at least seven and one-half months.

Dr. D. J. Doran, Animal Disease and Parasite Research Branch, A.R.S., USDA, Beltsville, Md., has studied infections of *T. axei* in calves. He reports that the manure may become soft and diarrhetic from the first to the eighth day after infection, while eggs do not appear in the manure until between 19 and 30 days after infection. Loss of weight and appetite and general weakness are other symptoms. Severe inflammation was found in the fourth stomach.

The life cycle of *Ostertagia ostertagi* has been studied at the Virginia Experiment Station. Eggs of this species hatch in about 24 hours and reach the infective stage in five to six days. The infective larvae become adults in about three weeks after gaining entrance to the digestive system by way of the mouth. The larval stages of these parasites are very resistant to adverse external conditions and have been found to remain infective on dry hay for over a year.

Treatment—The various treatments recommended for the removal of parasites are not very effective against these species, possibly because they are found embedded in the layer of mucus in close contact with the lining of the stomach and consequently are not easily attacked by the drug. Phenothiazine is recommended as the most effective drug for their removal. A discussion of its use will be found in the general section on treatment (page 46).

PARASITES OF THE SMALL INTESTINE

The Hookworm

This parasite (*Bunostomum phlebotomum*) is found in the anterior half of the small intestine, chiefly in the first eight or ten feet. A very few are usually recovered from the fourth stomach. These worms are about one-half to three-fourths inch long, relatively larger in diameter than the large stomach worm, and distinctly whitish in color. The females are for the most part noticeably larger than the males. Figure 3 shows the hookworm in comparison with other species. The two specimens on the left are males.

Life Cycle—The stages in the life cycle are shown in Figure 5. The eggs are laid in the contents of the intestine by the females and pass out with the manure. Hatching takes place in about 24 hours, and the larvae develop to the infective stage in seven to eight days during summer temperatures in Louisiana. Infection takes place by way of the mouth or by penetrating the skin while the calf is lying down on contaminated bedding or ground in the shade or pasture. Infection with severe symptoms and death has been produced in our experiments at Louisiana State University by placing the larvae on the skin. The time required for the larvae to develop to maturity in the calf varies from 52 to 79 days. During this time the larvae pass to the lungs, penetrate the tissues of the air spaces, and are coughed up and swallowed and complete their development in the intestine. Larvae have been recovered from the lungs of both sheep and calves, and it is possible that their presence plays a part in the development of pneumonia although this has not yet been determined.

Symptoms—Diarrhea has been found to develop in about a month after inoculation. There is a loss of flesh, unthriftiness, and other symp-

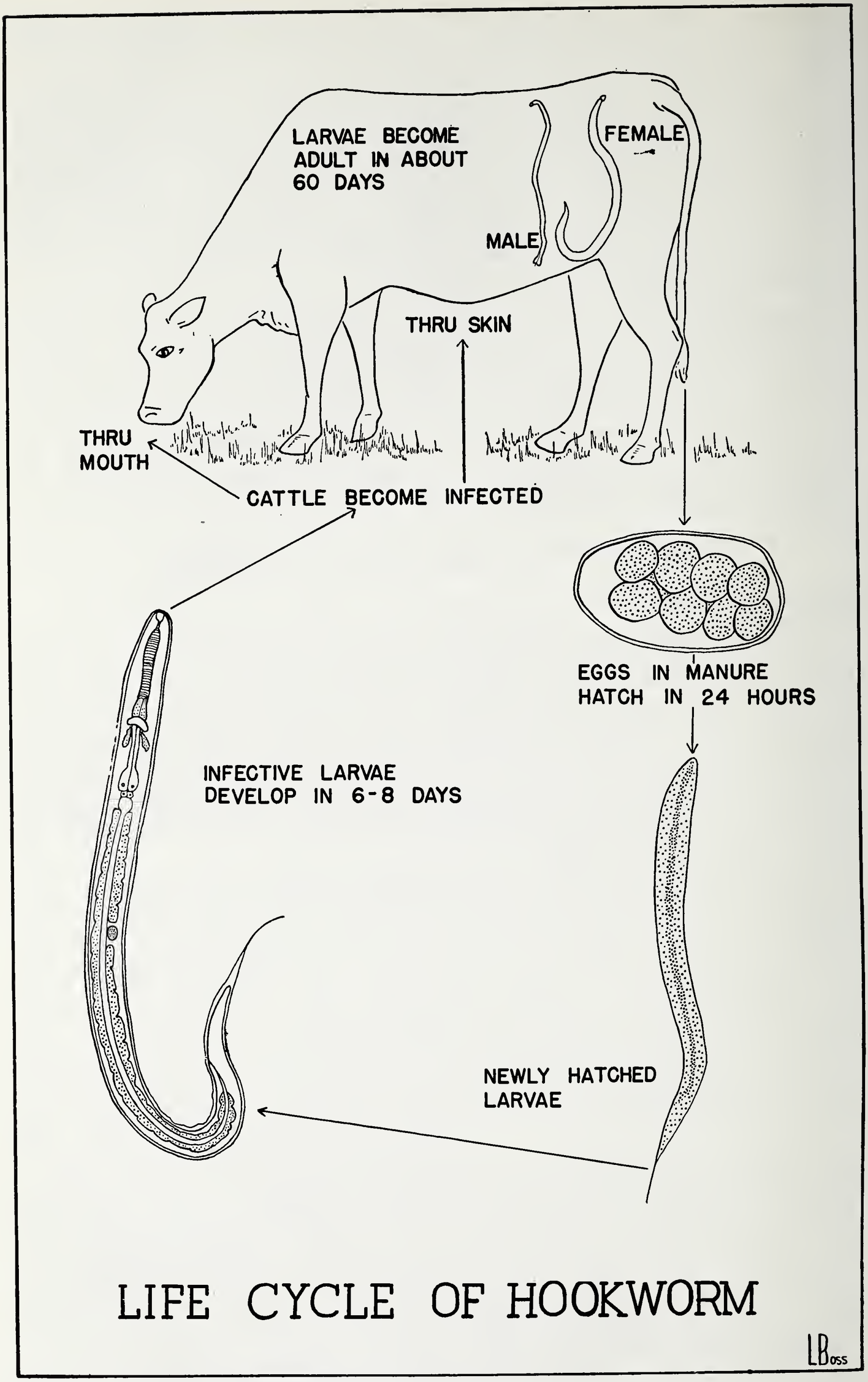
LARVAE BECOME ADULT IN ABOUT 60 DAYS
FEMALE
MALE
THRU SKIN
THRU MOUTH
CATTLE BECOME INFECTED
EGGS IN MANURE HATCH IN 24 HOURS
INFECTIVE LARVAE DEVELOP IN 6-8 DAYS
NEWLY HATCHED LARVAE
LIFE CYCLE OF HOOKWORM

FIGURE 5.

toms of parasitism. These observations agree with those made on sheep inoculated with the species of hookworm parasitic in sheep. It is evident that the symptoms of parasitism were caused by the larvae and not by the adults, since no parasite eggs of any kind were recovered from the manure during the period of diarrhea. During the period of adult life of the worms no symptoms developed. The length of life of the adult worms in the calf may be at least ten months, judging by the presence of eggs in the manure. It has been found that calves develop an immunity or resistance to this species in a manner much like they do to the large stomach worm and to the nodular worm.

Treatment—There is considerable question as to the value of either of the drugs discussed in the section of this bulletin on treatment. A limited number of experiments carried on at L.S.U. indicate that they are not effective against the adults of these parasites.

The Cooperias

Five species of small roundworms belonging to the genus *Cooperia* infect calves. No common name has been established for these parasites. They are relatively small, less than half an inch long, very slender and hair-like, and somewhat reddish in color when alive. Figure 3 shows some of these worms. They are more numerous in the front portion of the small intestine. Their resemblance to some of the fine sediment present in the contents is so close that it is sometimes necessary to examine them under the microscope to be certain of their identity. They are likely to be overlooked because of their small size unless the washing procedure described for the recovery of the small stomach worms is carried out.

Life Cycle—The life cycle of one of these, *Cooperia punctata*, has been studied in detail at L.S.U. and by Dr. W. S. Bailey at Auburn University, Auburn, Alabama. The details of the other species are probably similar to *C. punctata* and to the species found in sheep. Larvae hatch from eggs passed in the manure by infected animals and develop to the infective stage in about a week. After reaching the digestive tract of the calf, the larvae develop to sexual maturity and begin passing eggs in from 9 to 17 days. Diarrhea may begin between the fifth and ninth day after infection.

The length of life of the adults of *Cooperia punctata* was found by Dr. Bailey to be as long as nine months. Five animals in our experiments at L.S.U. have remained infected as follows: 13½, 14, 15, 21½, and 24½ months. Two additional ones had exceptionally long records of infection from the original inoculation, namely 4 years 3 months and 4 years 5 months. The infections in 24 others were cut short by the development of immunity within a week or few months after the appearance of eggs in the manure. The length of the natural life of adult parasites plays a very important part in the control program. This is especially important in the case of species against which anthelmintics have little or no effect.

Twenty-six animals infected with pure cultures of *Cooperia punctata* have developed an immunity, which was demonstrated by resistance to reinfection. Three of these animals were kept for 2 years and were still resistant to reinfection. After they were demonstrated to be immune to *C. punctata* they were successfully infected with the nodular worm and *Trichostrongylus axei.* Animals immune to the nodular worm have likewise been infected with *T. axei.*

Symptoms—This parasite is capable of producing severe symptoms such as diarrhea, loss of weight and appetite, and death in severe infections. The anterior 10 feet of the small intestine show numerous tiny hemorrhagic spots, and occasionally larger areas are affected in this manner. Beyond the first 10 feet these spots gradually decrease and the posterior half of the small intestine appears normal. Larvae and adults may be found embedded in the wall of the anterior portion of the intestine, but generally they are found only in the contents.

Treatment—No effective treatment has been recommended for the removal of the adult Cooperias. Phenothiazine removes only a small percentage or none at all, according to our experimental results.

Trichostrongylus colubriformis

Trichostrongylus colubriformis is another species found in the small intestine. Pure infections of this parasite can cause the death of calves, according to the investigations of Harry Herlich at the U.S.D.A. Regional Animal Disease Research Laboratory, Auburn, Ala. The symptoms are the same as produced by *T. axei,* which is found in the fourth stomach. Eggs were first recovered from the manure in from 15 to 23 days after inoculation.

The Ascarid

This parasite (*Neoascaris vitulorum*) is found in the small intestine of cattle. It is a very large worm 6 to 12 inches in length and has approximately the diameter of a pencil.

Life Cycle and Symptoms—The stages of the life cycle and symptoms produced by *Neoascaris vitulorum* have not been fully studied because of unknown difficulties in producing experimental infections. Much evidence has been accumulated by Dr. Porter and Mr. Herlich, U.S.D.A. Regional Animal Disease Research Laboratory, Auburn, Ala., and by Dr. Refuerzo and other workers, Bureau Animal Industry, Philippine Islands, that infection of calves can take place before birth. It is the belief of these workers that infection probably takes place after birth also. Only very light infections occur in the U.S. but in the Philippine Islands, it is the cause of severe losses.

The life cycle is probably similar to that of the closely related species, *Ascaris lumbricoides,* parasitic in pigs. The eggs of this species are laid by the females in the intestine and pass out with the manure. Unlike many other roundworm eggs, the larvae do not hatch but they develop to the infective stage within the shell in about two weeks. It has been found that within the shell these larvae are very well protected against external conditions such as drying, freezing, and chemicals and may remain alive for years in some types of soil and in the shade. Infection takes place by way of the mouth. The larvae hatch in the intestine, penetrate the intestinal wall, and pass by way of the blood to the lungs, where they penetrate the tissues of the small air sacs and enter the air spaces. In the course of time they find their way up the air passages to the throat, are swallowed, and upon reaching the intestine complete their development. The presence of the larvae in the lungs of pigs causes a large amount of irritation and inflammation, and pneumonia is a frequent result. It is not reported that the cattle ascarid plays any part in pneumonia in calves, but it is possible that it does.

Thread-Necked Worms

These worms are half an inch to an inch long and have the head end somewhat more slender than the other. They are found in the small intestine and are highly reddish in color when alive. Two species have been distinguished, *Nematodirus spathiger* and *N. helvetianus*.

Life Cycle—The stages of the life cycle of *N. helvetianus* have recently been studied by Mr. Harry Herlich at the Animal Disease Research Laboratory, Auburn, Ala. The eggs are the largest of any of the roundworm parasites in cattle, ovoid in shape, clear and with 2-8 cells centrally located. The eggs of these worms also differ from other nematodes in that the larvae do not hatch until they reach the infective stage, while others hatch much earlier and complete their development outside the shell. Thus, they possibly take advantage of the protection offered by the shell during this part of their development. Eggs begin to appear in the manure in from 21 to 26 days after the calf becomes infected. Symptoms of the infection—diarrhea, loss in weight, etc.—begin to develop about 14 days after infection. The species of Nematodirus parasitic in sheep have similar life cycles and cause serious symptoms.

Strongyloides papillosus

These are very small roundworms nearly microscopic in size that are found in the small intestine. They are so small that they will be overlooked at post-mortem examinations unless a special effort is made to recover them. A microscopic examination of the manure will reveal the presence of the eggs. Observations of calves under controlled conditions of infection indicate that these worms can be the cause of an intermittent diarrhea and a generally upset digestive system that result in the calf's being in poor condition for a long period of time.

The course of the infection and the damage done by this parasite have been studied in experimental infections by H. H. Vegors, Regional Animal Disease Laboratory, Auburn, Ala. It has a general distribution and probably more than 75 per cent of the calves in the Southeastern states become infected under 4 months of age. Animals become much more readily and severely infected when larvae are placed on the skin than when given by mouth. Eggs are found in the manure during the second week (9 to 11 days) after infection. Diarrhea usually occurred during the first and second weeks after infection and continued intermittently for as long as 3 months. Weight gains were 35 to 75 per cent less than in uninfected calves of comparable ages. Infected animals develop an immunity which gives nearly complete protection against reinfection. Sheep and goats are also infected with this worm, in which it produces the same symptoms.

ROUNDWORMS OF THE ABDOMINAL CAVITY

Frequently, when cattle are being slaughtered for meat or at a postmortem examination, slender white worms 2 to 4 inches in length will be found in the fluid from the body cavity or among the internal organs. Figure 3 shows some of these worms in comparison with other species. These are commonly called body cavity worms and have the scientific name *Setaria labiatopapillosa*. They, insofar as is known, do not cause any damage to the cattle and do not injure the meat in any way for human consumption. Although the life history of these worms has not been studied, it is probable that it is similar to that of related species found in other animals. Eggs are not produced, but larvae deposited in the body fluids, such as lymph and blood, are transmitted to new hosts by bloodsucking insects.

PARASITES OF THE LARGE INTESTINE

The Nodular Worm

This parasite is called the nodular worm because of the small, hard lumps or nodules which the larvae cause to develop in the walls of the posterior portion of the small intestine and caecum. The scientific name of this worm is *Oesophagostomum radiatum*. A related species, *O. columbianum,* occurs in sheep. The adults are found in the caecum and anterior portion of the large intestine and are about one-half inch long. They differ from the other roundworms of cattle in that a portion of the anterior end is bent in the shape of a walking cane, and the females for the most part have a dark-colored spot near one end. Figure 3 shows some of these worms in comparison with other species. The three smaller specimens on the left are males and the others are females.

Life Cycle—The eggs, which are deposited in the manure, hatch in about 24 hours at a temperature of 70 to 85 degrees. Figure 6 shows stages in the life cycle. The larvae reach the infective stage in about five days after the eggs are expelled in the manure. Infection takes place very readily by way of the mouth, the larvae being acquired on contaminated grass or hay cut from infested pastures. After infection has occurred the larvae reach maturity and begin laying eggs in from 33 to 44 days.

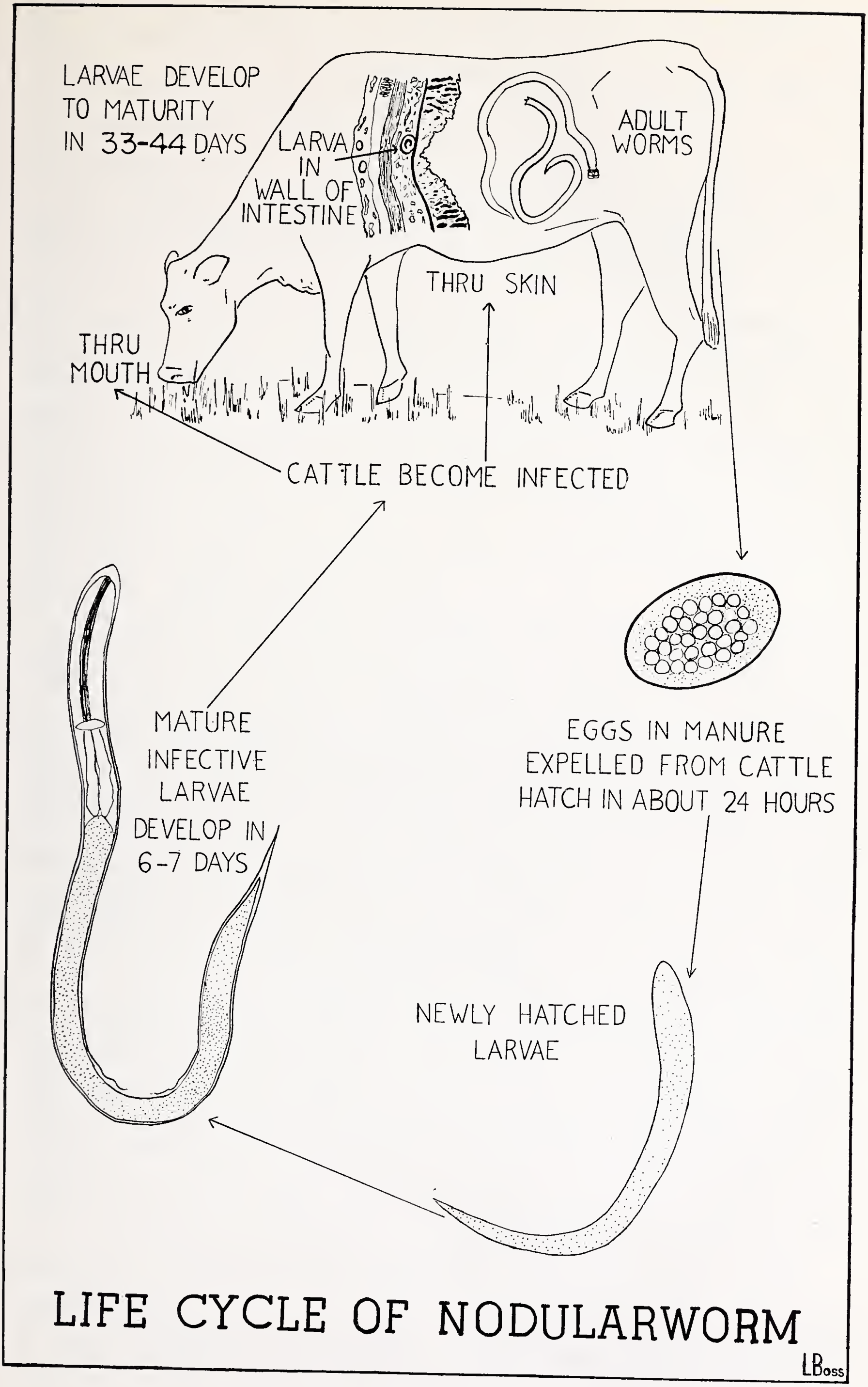
LARVAE DEVELOP TO MATURITY IN 33-44 DAYS
LARVA IN WALL OF INTESTINE
ADULT WORMS
THRU SKIN
THRU MOUTH
CATTLE BECOME INFECTED
MATURE INFECTIVE LARVAE DEVELOP IN 6-7 DAYS
EGGS IN MANURE EXPELLED FROM CATTLE HATCH IN ABOUT 24 HOURS
NEWLY HATCHED LARVAE
LIFE CYCLE OF NODULARWORM
LBoss

FIGURE 6.

Experiments at the Louisiana Agricultural Experiment Station indicate that the larvae also produce light infections by penetrating the skin. The larvae were placed on the skin of the flanks of two calves that were free of parasites and kept under conditions free of parasitic infection. The calves were then placed in stanchions so they could not lick themselves until the eggs appeared in the manure. Therefore, it seems advisable to consider that poorly cleaned barns and the contaminated soil of shade areas as well as the pasture are potential sources of infection. Calves also may lick the larvae from their hair after lying down in contaminated places.

Symptoms—The larvae, upon reaching the posterior half of the small intestine and caecum, penetrate the tissues of the wall until they get about halfway through. There they grow and develop partly into the adult stage, and their presence causes severe disturbances which result in thickening of the wall and rupturing of small blood vessels, causing bleeding into the intestinal cavity. These disorders interfere with normal digestion and absorption and cause a diarrhea of varying degrees of severity. The discharge becomes very watery, sometimes is bloody, and usually has a very disagreeable odor. The calf may begin to lose its appetite in four or five days after inoculation. Some become very weak and emaciated and those that survive the acute stages of the infection will remain in a weakened condition for a month or two before they show much improvement. Some individuals gain very little weight while others lose weight rapidly during the time the larvae are in the intestinal wall. After the larvae leave the intestinal wall and remain in the cavity of the large intestine the damaged tissues heal and the animals begin to show some improvement in condition, although they may remain weak, in poor flesh, and with a rough coat for months. Some individuals in our experiments that live, improve slowly with good feed and care for six months or more and then die quite suddenly when the feed gets less nutritious and the weather unfavorable. This probably accounts for the deaths of some animals during winter or under conditions of poor feeding and management. In severely affected animals the number of eggs was very greatly reduced and very few worms were recovered at post-mortem examination, an indication that it was not the adult worm that was the cause of the condition of the animals. Treatment of animals in such a weakened condition may result in their death, since the drugs which kill the adult worms are more or less poisonous to the calves as well as to the worms. Nothing is known about the removal of the larval stages by treatment. Good care, good feed, and protection from unfavorable weather are of first consideration for animals suffering from such parasitic infections.

Animals that survive the acute stages of larval nodular worm infection regain their strength during the adult stage of the parasites. Eventually they develop an immunity or resistance to the adults and larvae as indicated by the reduced number of eggs recovered from the manure and by failure to develop symptoms and by failure to become reinfected when reinoculated.

Treatment—Phenothiazine as discussed in the general section on treatment is recommended as the most effective and safest treatment for the removal of these worms.

The Whipworm

The whipworm (*Trichuris ovis*) is found in the caecum or blind gut of cattle, sheep, and goats. It gets its common name from its resemblance to a whip and consists of a long, slender anterior portion corresponding to the lash and a thick posterior portion corresponding to the handle. The total length is 2 to 3 inches, two-thirds or more of the total being slender. The color of the worm is white. Figure 3 shows some of these worms in comparison with other species.

Life Cycle—The life cycle has not been studied in cattle or sheep, but it probably closely resembles that of related species in man and dog. In these related species the eggs do not hatch, but the embryo develops to the infective stage within the protective shell. When the eggs are swallowed the embryos are freed in the digestive organs and develop to the adult in the caecum.

Symptoms—The slender anterior ends of the worms are usually found piercing in and out as if sewed into the inner layers of the caecal wall. In man when the worms are numerous a low grade inflammation is set up. Severe symptoms may develop in dogs, but in cattle and sheep it is not thought that any serious damage is done. It would seem, however, that bacterial invasion of the tissues might easily follow the penetration of the anterior portions of these worms into the tissues and be a contributing factor to the effects of other parasites if the infection is heavy.

Treatment—No effective treatment is known for the removal of these parasites.

TAPEWORMS

Tapeworms, in the adult or egg producing stage, are long, ribbon-like, segmented parasites found in many of our domestic animals. The eggs that are produced by the adults must undergo a period of larval development in another kind of animal before the adult stage is again reached. As an example, one of the tapeworms that are found as adults in cattle and sheep undergoes its larval development in small grass-mites similar to red bugs, and one of the species (*Taenia saginata*) that pass their larval development in cattle has its adult form in man. Man is not susceptible to infection with the adult forms of either of the two species found in cattle and sheep.

Adult Forms

The Moniezias—The two species of this genus found in cattle are *Moniezia expansa* and *M. benedeni*. They are indistinguishable from each other in size and external appearance but differ internally. *M. benedeni* is more often found in cattle while *M. expansa* is more often found in sheep. They are found in the small intestine and are flat, ribbon-like worms many feet long. Lengths up to 30 or 35 feet may be recovered although they are generally broken into shorter pieces in the process of opening the intestine. Upon examination they are found to be divided into joints or segments and if an entire worm is followed to each of the ends, one will be found to widen to a maximum of three-fourths of an inch. The other end will become narrower, and at the very end will be found a small, bead-like structure, the head or scolex by which it attaches itself to the wall of the intestine. Figure 3 shows a small portion from the central region of a tapeworm.

Life Cycle—Stages in the life cycle of these tapeworms are shown in Figure 7. The eggs escape to the outside in the manure, but in order for them to develop into adult worms they must be eaten by small mites. These small mites are similar to red bugs in some respects. They frequent the soil and vegetation and feed, insofar as is known, on decaying vegetation, bacteria, molds, etc., in decomposing manure containing the eggs. Within these mites the tapeworm eggs hatch and the small embryo develops to the infective stage. The infected mite is carried into the digestive tract of cattle, sheep, and goats on contaminated feed, where the larvae are freed from the mite and develop into adult tapeworms. Infection experiments have not yet been carried out using cattle, but in sheep the larvae require about 40 days to reach maturity and the adult worms continue to produce eggs for about two months. Development of the larvae in the mite requires three and one-half to four months. Some experimental observations indicate that pastures can remain infective 17 to 22 months.

Symptoms—There is some disagreement as to the amount of injury done by the tapeworms, but experimental observations carried out with sheep indicate that no serious damage is done. No observations have been made on cattle. Animals under field conditions are usually found to be infected with other parasites as well, so that it is difficult to assign to each the exact amount of damage.

Treatment—An effective treatment for the removal of these worms has not been found. Among those that have been recommended are kamala, copper sulphate, oleoresin of male fern, nicotine sulphate, and sodium arsenite. The effectiveness of these, however, seems to be still in question and, besides, they are more or less toxic and dangerous to the animal.

Larval Forms

Beef Measles—This condition of beef is caused by the presence of the larvae of a species of tapeworm found in man and may be recognized by the presence of small, whitish, spherical or elliptical cysts one-eighth to three-eighths of an inch in size, more or less embedded in the muscle. They are usually most numerous in the jaw muscles and the heart

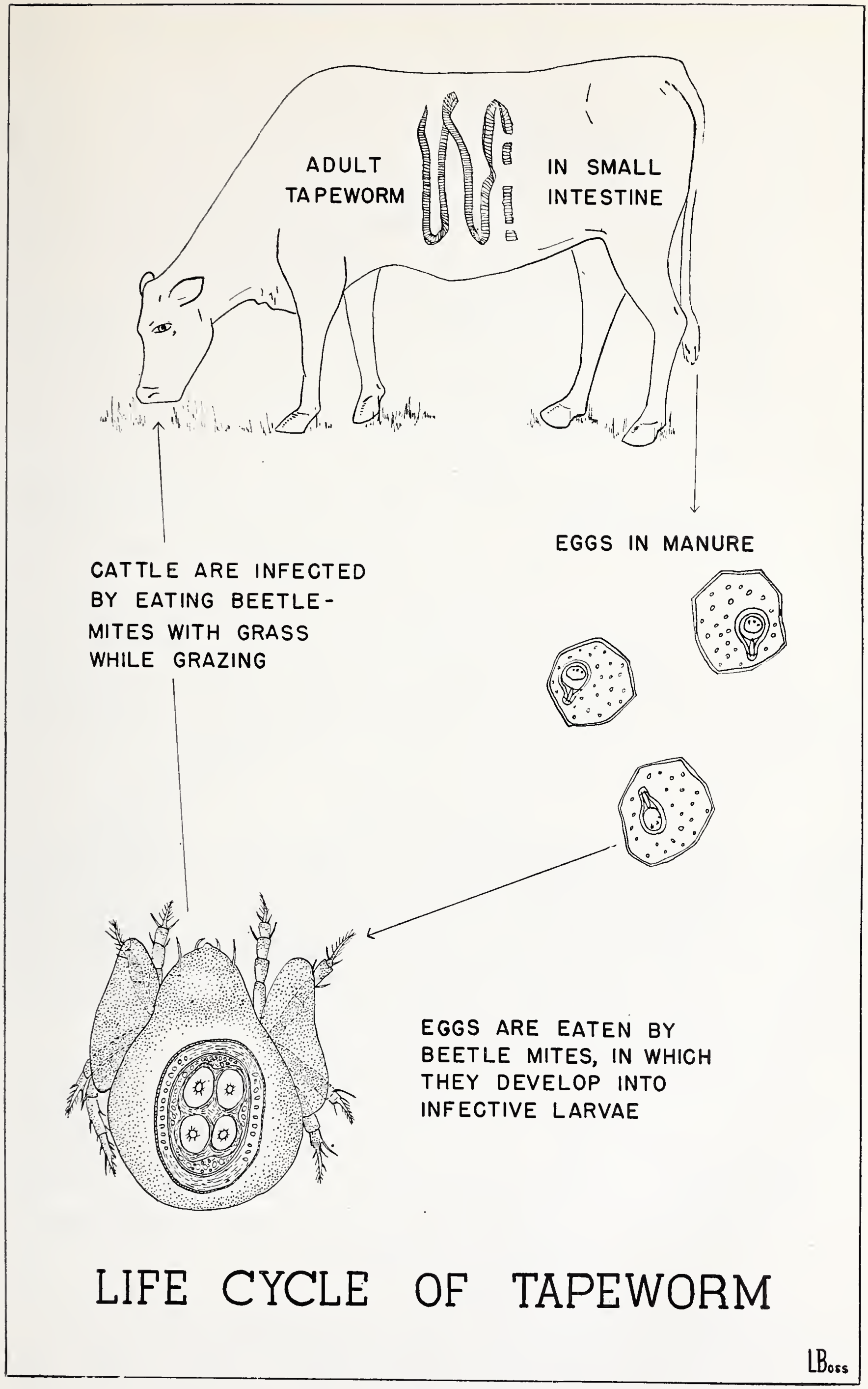
ADULT TAPEWORM
IN SMALL INTESTINE
EGGS IN MANURE
CATTLE ARE INFECTED BY EATING BEETLE-MITES WITH GRASS WHILE GRAZING
EGGS ARE EATEN BY BEETLE MITES, IN WHICH THEY DEVELOP INTO INFECTIVE LARVAE
LIFE CYCLE OF TAPEWORM
LBoss

FIGURE 7.

but may occur in any part of the body. No symptoms are produced by these larvae in cattle. These larvae develop into the adults of the tapeworm *Taenia saginata* in the intestine of man when the infected beef is not properly refrigerated or sufficiently cooked. The eggs deposited by the adults are passed in the human feces and cattle become infected from contaminated pastures or feed in the feed lots. Upon gaining entrance to the digestive system of cattle, the larvae are freed from the shell, then penetrate the intestinal wall and gain access to the circulatory system, by which they reach the heart muscles or other parts of the body in which they develop to the infective stage.

The Hydatid Cyst—The hydatid or echinococcus cysts contain the larval forms of a tapeworm (*Echinococcus granulosus*) parasitic in dogs and other carnivorous animals. The cysts are whitish, tough-walled objects more or less embedded in the livers of cattle and hogs. They vary in size from one-fourth inch to as large as six inches in diameter and, although most commonly found in the liver, may develop in the lungs and several other organs. Infected livers should not be fed to dogs, since dogs very readily become infected with the small adult tapeworm about one-half inch in length, a very large number developing usually from even a single cyst. The injury done to cattle by the cysts is not great unless the number is very large. However, infected portions of livers, and if heavily infected, the entire organ, must be discarded. This is a cause of considerable economic loss. Another danger of considerable consequence, although not common, is the possibility of accidental infection with the cysts of persons who are associated with dogs infected with the adult tapeworms.

LUNGWORMS

The lungworms are parasites of the trachea and bronchial tubes of the lungs and are especially serious in calves. They are rather long, whitish, thread-like worms two to four inches in length and are found by opening the bronchial tubes, which are the air passages leading into the lungs. These air passages should be followed out to the smaller divisions and the walls and especially the frothy mucus that may be present examined for the presence of the worms.

Life Cycle—A diagram showing the stages of the life cycle of the lungworm is shown in Figure 8. The adult females deposit eggs in the air passages of the lungs, where some hatch, and the larvae, together with the unhatched eggs, become entangled in the mucus and are coughed up and swallowed. The eggs that have not hatched in the lungs hatch in the intestine, and the larvae are discharged in the manure. These larvae are not infective but require about four days in the open in which to develop to that stage. Infection occurs by way of the mouth on contaminated hay, grass, or in water. The larvae, upon reaching the intestine, penetrate its wall and gain access to the lymphatic system, in which they travel to the lungs, reaching there in about ten days. The larvae, when swallowed in large numbers, may cause digestive disturb-

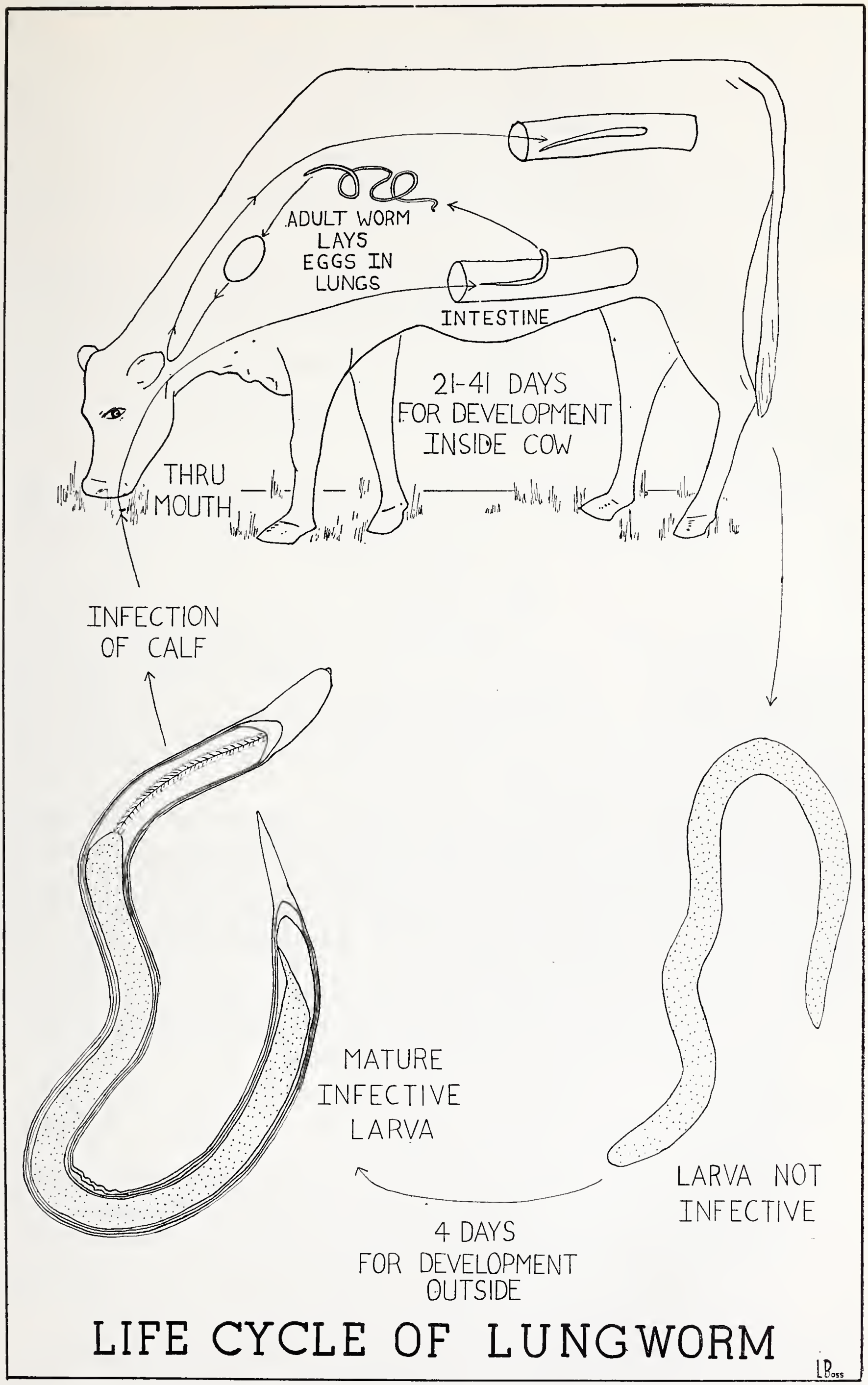
ADULT WORM
LAYS
EGGS IN
LUNGS
INTESTINE
21-41 DAYS
FOR DEVELOPMENT
INSIDE COW
THRU
MOUTH
INFECTION
OF CALF
MATURE
INFECTIVE
LARVA
LARVA NOT
INFECTIVE
4 DAYS
FOR DEVELOPMENT
OUTSIDE
LIFE CYCLE OF LUNGWORM
L.Ross

FIGURE 8.

ances as they penetrate the intestinal wall, and diarrhea may develop. In a similar manner, as they enter the air passages of the lungs from the capillaries they cause tiny hemorrhages which may lead to pneumonia. The irritation caused by the adults is said to be the most serious result from infections with this parasite. The larvae reach maturity usually in from 21 to 30 days but occasionally not until 41 days after being swallowed. The length of time animals continue to pass larvae in the manure is short, and varies from 27 to 72 days in different individuals.

An immunity develops in animals that live, and they are resistant to reinfection. Michel, working in England, believes that symptoms may be produced in immune animals after a year but the larvae are prevented from reaching the adult stage and producing eggs and larvae. Vaccination with irradiated larvae shows considerable promise as a preventive procedure but this still is in the experimental stages at the present writing.

Symptoms—Animals begin to show symptoms between 8 and 26 days after infections. The adult worms cause a catarrhal condition which results in excessive mucus formation sometimes colored with blood. This mucus contains the eggs and hatched larvae of the adult worms and is coughed up and, for the most part, swallowed. Severe infections cause coughing, difficulty in breathing, discharge from the nose, and a general unthriftiness manifested by loss in weight, rough coat, and sometimes diarrhea. Pneumonia may also develop as a result of the larvae penetrating the walls of the air passages on their way from the blood vessels to the lungs and also as a result of the irritation developed by the adult worms.

Treatment—The subject of treatment of lungworm infections is considered at this time because the methods are so different from those employed in other parasitic infections. In general, the treatment of animals infected with lungworms has proved unsatisfactory up to the present time. The various methods that have been employed may be grouped under the following heads:

1. *Administration of drugs as liquids into the trachea.* Among those tried are chloroform, turpentine, iodine, creosote, benzene, pyrethins in olive oil, and carbon tetrachloride.
2. *Administration of drugs as vapors into the trachea.* Among those tried are ether, oil turpentine, sulphur dioxide, chloroform, chlorine, ammonia, and formalin.
3. *Administration indirectly through the digestive tract and intravenous and intramuscular injections.* Carbon tetrachloride when administered by mouth is eliminated by the lungs and in this way it comes in contact with the worms, but it is very dangerous to cattle. Various copper salts have been tried by intravenous and intramuscular injection but not with promising results.

While experimental results show that some of these drugs kill some of the worms, the introduction of such substances into the lungs and otherwise into the animal in many instances has resulted in very serious damage. Most of these substances, it will be noted, are highly irritating to the delicate membranes lining the respiratory passages and, consequently, when present in sufficient quantity to kill the worms, produce complications that often lead to serious results.

Care of Infected Animals—The best procedure to follow in handling animals infected with lungworms is to provide the best of care possible in the way of shelter, feed, and pure water. Remove the animals from the source of infection and do all that is possible to aid the infected animals to live with the parasites until they outlive them.

Prevention—Calves especially should not be allowed to graze with older animals that are infected or be pastured on the ground formerly grazed by such animals. Low, wet pastures should be avoided, overstocking should not be allowed to occur, especially where young stock is concerned, and a plan of rotation should be adopted if possible. Resting a well-drained pasture for six weeks will usually allow the infective larvae to die out. Longer periods, however, are advisable if it is at all possible. It has been determined that the adult worms may live in the lungs from one to four months.

LIVER FLUKES

Common Liver Flukes

The common liver fluke (*Fasciola hepatica*) is a flat, leaf-like worm one-half to one and one-fourth inches in length and is found in the bile ducts and gall bladder of cattle, sheep, goats, and sometimes pigs. It is also found occasionally in the lungs as well as in the liver. Figure 3 shows some specimens of this parasite. The walls of the bile ducts are more or less thickened, depending on the number that are present, and have a gritty calcareous deposit adhering to their inner lining. The flukes are freed by cutting open the ducts. They are sluggish, flat worms with a small, cone-like projection at one end bearing a tiny, dot-like depression, the oral sucker. On one of the flat surfaces a short distance from this cone-like projection is the ventral sucker. When examined under the microscope, the surface of the fluke is found to be covered with minute, sharp spines which contribute to the irritation of the walls of the bile ducts, causing the changes described above. In some instances the damage to the duct wall and the resulting deposits of calcareous material are so great as to obstruct the flow of bile. There is also a large amount of damage done to the liver tissue during the wandering of the larvae through it, referred to later under "Life Cycle." This results in the formation of whitish, tough scar tissue which not only interferes with the normal functions of the liver but also renders it tough and unfit for food.

In the United States the liver fluke is found in the Pacific Coast, the Rocky Mountain, and the Gulf Coast states. It is prevalent in low, wet pastures and wherever suitable snails are present for the develop-

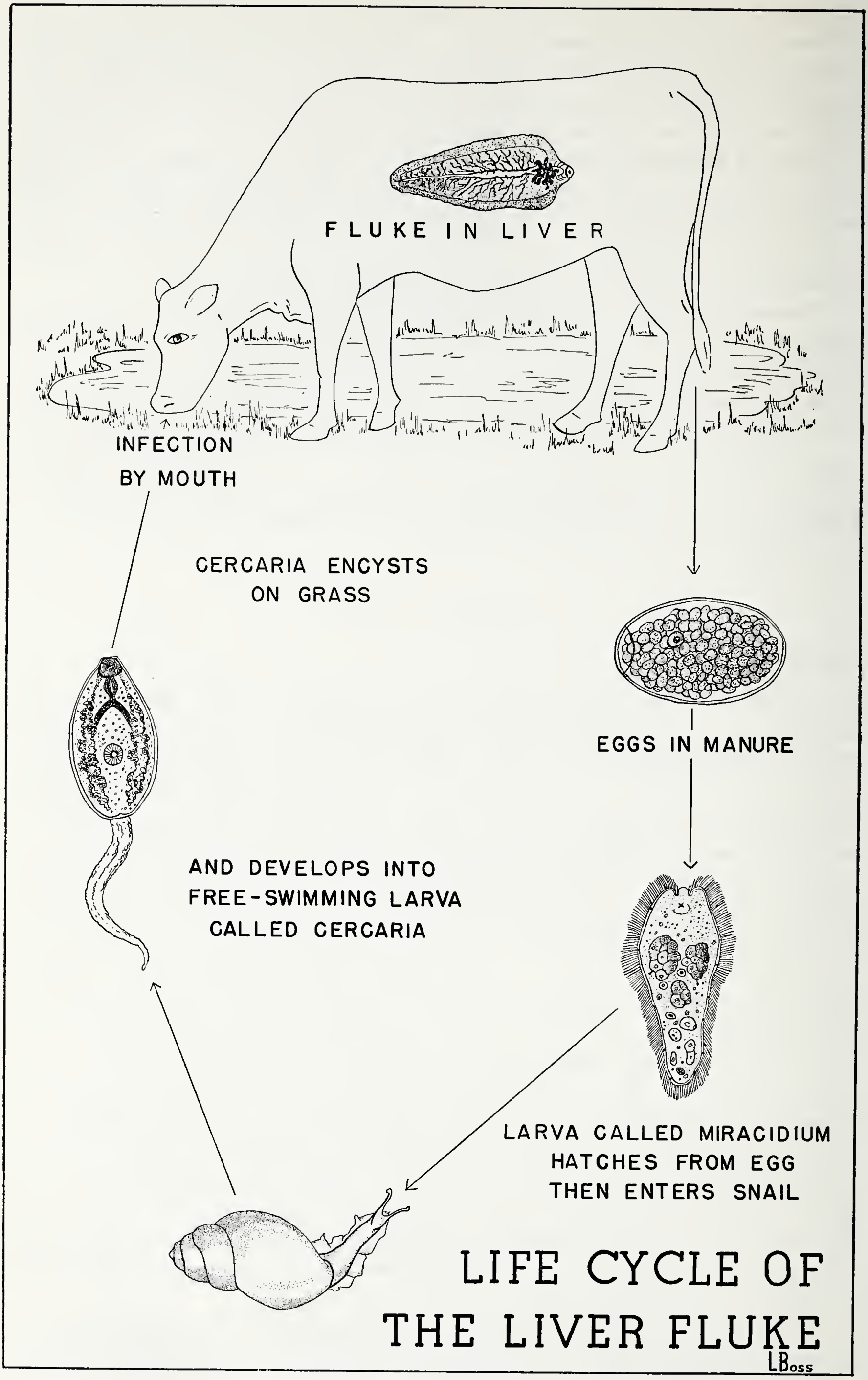
FLUKE IN LIVER
INFECTION BY MOUTH
CERCARIA ENCYSTS ON GRASS
EGGS IN MANURE
AND DEVELOPS INTO FREE-SWIMMING LARVA CALLED CERCARIA
LARVA CALLED MIRACIDIUM HATCHES FROM EGG THEN ENTERS SNAIL
LIFE CYCLE OF THE LIVER FLUKE
LBoss

FIGURE 9.

ment of the larval stages. The economic losses from liver fluke infections have been listed under the following headings: livers unfit for food at slaughtering, loss of flesh due to resulting unthriftiness, loss due to deaths, decreased milk production, and reduced breeding efficiency because of the unthrifty condition. The exact amount in dollars, of course, cannot be determined, owing to the impossibility of securing accurate and complete information, but it must be a large sum annually. The losses from condemned livers alone is estimated at between 3½ to 4 million dollars annually.

Life Cycle—The stages in the life cycle of liver flukes are shown in Figure 9. The eggs are laid in the bile ducts and pass to the intestine in the bile and then out of the digestive tract in the manure. A small larva called a miracidium hatches from the eggs in from 7 to 10 days and, in order for it to develop further and be able to produce infection, it must penetrate the body of certain species of snails. The particular kind of snail necessary is a water snail and is found in moist and marshy places only. After it penetrates the snail, several developmental and multiplication stages develop from this small larva. As a result several hundred small, tadpole-like organisms, the cercariae, in the course of time escape from the snail and encyst on grass or other objects. In this condition they wait until they are taken into the digestive organs of the cow. In this encysted condition the cercariae are able to withstand a certain amount of heat and drought although they are in time killed by the hot, dry weather of summer. The total time required for the development in the snail is about 7 weeks.

When the cercariae are taken into the intestine with grass or hay, they penetrate the wall and wander about in the abdominal cavity until they come in contact with the liver. Then they penetrate this organ and feed on its tissues for about two months. During this time they burrow about, causing a large amount of injury and destruction of the living tissue which nature attempts to heal by the formation of the tough, whitish scar characteristic of healed wounds. This can be seen on the surface of the livers of fluke-infected animals that have been slaughtered. This destruction of the liver and the formation of the resulting scar reduces and interferes with the normal functions of the liver and renders it unfit for food.

After about two months spent in the liver, the larvae resemble small adult flukes in appearance and are now ready to pass into the bile ducts, where they grow and develop into adult flukes in about a month. Under favorable conditions the complete cycle of stages of development may be completed in about five months but may be delayed to some extent by external factors such as low temperatures.

Liver flukes and viable eggs have been recovered from sheep experimentally infected and kept under conditions which prevented later infections for 7 years in one animal and for 11 years in another at the Animal Disease Research Center at Beltsville, Md. Thus, without treatment, animals can be a source of infection for a long time.

Symptoms—The symptoms of liver fluke infections do not differ in essential details from those of other parasitic diseases. Animals with light infections sometimes remain in an unthrifty condition in spite of good pasture and care and fail to respond with the expected gains when put in the feed lot. Where the infection is heavy, animals go down in condition with general symptoms of other parasitic infections, and death is invariably the result, especially if the animals are young. The finding of the liver fluke eggs in the manure by an experienced laboratory worker is necessary to determine the presence of adults.

Treatment—If liver fluke infection is suspected, the owner should, if at all possible, consult a competent veterinarian or communicate with his state livestock sanitary board for advice and assistance in diagnosis and in the administration of the drugs.

Carbon tetrachloride has been recommended as a treatment, but, while it seems to destroy the flukes rather effectively, it is so toxic to cattle that it is dangerous to use. The drug is especially toxic to milking animals and to those in a weakened condition.

Hexachlorethane is an effective treatment for the removal of the adults in the bile ducts but does not affect the larvae that are still in the liver. It should be remembered that the larvae are the cause of serious and permanent damage to the animal and that a complete cure of all animals is impossible, since nature is powerless to repair all the damage done by the larvae. A very important thing to remember about the employment of treatment is the destruction of the adult and, consequently, the elimination of the eggs as a source of infection for other animals during the present and following seasons. It is advisable to continue the treatment of animals on infected pastures for several seasons in order to prevent the number of parasites from increasing and reaching dangerous proportions. Treatment of infected animals that have not been too seriously damaged by the larvae is said to result in rapid improvement.

The following directions for the use of hexachlorethane are quoted, by permission, from a circular by Dr. O. Wilford Olsen (Nov. 1944, while he was associate zoologist, Bureau of Animal Industry, Zoological Division, U.S.D.A.) who made an extensive study of the use of this chemical at the Texas Agricultural Experiment Station at Angleton, Texas. (Now at Colo. State Univ.)

"The drug should be prepared as an aqueous suspension and administered as a drench.

"The hexachlorethane suspension is prepared by mixing the ingredients on the basis of one pound of finely ground hexachlorethane (60-mesh size) and 1½ ounces of bentonite (a finely powdered clay) with 25 ounces or slightly over 1½ pints of water. The addition of about one-quarter teaspoonful of white flour facilitates the mixing and improves the resulting suspension. Mixing should be done with a power-driven apparatus of sufficient speed and force to insure thorough distribution of the ingredients. When mixed in the above proportions approximately one quart of the suspension is produced.

"A measured dose of 6½ ounces of the suspension for cattle and 3¼ ounces for calves over three months old is given by means of a metal dose syringe of 4-ounce capacity or greater. Calves under three months of age need not be treated because any flukes they may harbor would be too young to be killed by the treatment.[1]

"When administered as an aqueous suspension, hexachlorethane has a wide margin of safety for the treatment of all classes of range cattle, with the exception of very debilitated ones. Extremely weak animals should be treated with caution since, occasionally, unfavorable effects such as staggering and reeling, sometimes prostration and death, may result from giving a full dose.

"One dose of hexachlorethane suspension is usually sufficient to kill the adult flukes in the bile ducts; young flukes are somewhat resistant to the treatment. The dead flukes pass from the liver by way of the common bile duct into the intestine and to the outside with the droppings.

"In cases where the poor or unthrifty condition of the cattle is due to liver flukes, there is generally a remarkable improvement in the weight and appearance of animals within a short time after treatment with hexachlorethane. Exceptions occur, however, in instances where the damage to the liver is so extensive that the animals are unable to recover, even though the flukes that they harbored are destroyed.

"In planning a program for controlling liver flukes, the time of treatment should be chosen so as to take advantage of the weakest point in the life cycle of the fluke. In general the flukes are the most vulnerable in the spring and fall, and it is probably at this time that the treatment may be given most advantageously.

"In the Gulf Coast region, the season of snail activity is during the mild, wet winter and spring. It is during this time that the infective stages of the liver fluke are able to come out of the snails and get on the grass. Treatment of all the cattle in the herd in the spring, or at the beginning of the dry season, when the snails go into the soil, and again in the late fall before the onset of the wet season, gives excellent results. This arrangement takes advantage of the fact that many of the cysts on the pasture have been killed by the heat and drought during the summer, and the majority of the flukes already in the liver are mature and readily killed before the snails become active again in the winter.

"In regions where cattle are taken off pastures and not subjected to continuous infection during the cold winter months, treatment should be given at the time when the animals are removed from the infested range in the fall and again in the spring before they are returned to it.

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[1] The drug is available in prepared form from veterinary supply houses. When it is purchased from such a source care should be observed to follow the directions given by the manufacturer for administration. (Author's footnote.)

The fall treatment kills the flukes that have reached maturity during the grazing season and the spring treatment destroys those flukes that were too small to be readily killed at the time of the first treatment. Animals treated in this manner should be practically free of parasites when they are returned to the range. Such a program not only kills the greatest number of flukes, but also reduces the possibility of infection of more snails on the pasture the next grazing season. A program of drenching cattle twice a year, however, will not eradicate liver flukes, but it will greatly reduce their numbers and improve the health of the cattle."

The Lancet Fluke

The lancet fluke (*Dicrocoelium dendriticum*) is a recent importation to North America and to date is known to occur only in Canada and New York. It has been known to occur in six counties in central New York since 1941. The rapid spread of this newly introduced parasite should be cause for alarm, since in Europe it has been found to be a menace to the livestock industry. It is a parasite of many wild and domestic animals and thus could become rapidly distributed and established if the proper intermediate hosts were available. In New York it has been found in the woodchuck, white-tailed deer, cattle, sheep, goat, and horse. Extensive and careful studies were carried out at Cornell University by Drs. C. R. Mapes and W. H. Krull on this parasite. The reader is referred to Volumes 41 and 42 of The Cornell Veterinarian for an account of their work.

The lancet flukes are 5 to 15 mm. (3/16-9/16 inch) in length and 1.5 to 2.5 mm. wide. They are thus much smaller than the common liver fluke, which is about 1.25 inches in length, and have been mistaken for the larval stages of the latter. The pathological changes resulting from infection with this parasite are confined to the liver. The normal cells are destroyed and become replaced by scar tissue, resulting in extensive cirrhosis, and thus large areas of the liver cease to function normally. These changes increase in extent and severity with the duration of the infection, and no evidence has been found of the building up of an immunity or resistance which develops in the case of some other parasitic infections. Pathological changes of this nature are permanent and, therefore, little improvement in the condition of the infected animal can be expected. No drugs have been found that are effective in removing the parasites up to the present time.

Life Cycle—The life cycle of the lancet fluke differs from that of the common liver fluke in that there are two intermediate hosts instead of one. The larvae that hatch from the eggs that are discharged in the manure of the infected cow, sheep, etc., undergo certain stages of development in a small terrestrial snail (*Cionella lubrica*). These larvae then must enter the body of an ant (*Formica fusca*) where they develop further into the larvae that are capable of infecting the final host. The final host (cattle, sheep, etc.) then becomes infected by accidentally eating the ants while grazing. The establishment of the parasite in a new location is dependent on its finding there both of the proper intermediate hosts.

Fascioloides magna

Another species of liver fluke (*Fascioloides magna*) may be found in cattle in locations where they graze over the same areas as deer. It seems that the deer is the normal host for this parasite and, when it succeeds in infecting cattle, it is encapsulated or walled off and destroyed in the liver; therefore, it does not spread from cattle to cattle, but only the deer serves as a source of infection. There is a considerable amount of damage done to the liver by the larvae of this species, and because of this they are of economic importance. Eggs are not discharged in the bile ducts; consequently, infection cannot be determined except at post-mortem examination.

COCCIDIA AND COCCIDIOSIS

The coccidia belong to the group of simple one-celled animals called protozoa and produce the disease called coccidiosis or bloody diarrhea. Coccidiosis occurs not only in cattle but also in chickens, cats, dogs, pigs, sheep, goats, rats, sparrows, etc. There are many species of coccidia involved in the production of the disease, and it should be emphasized that species infective for one animal are not infective for another with but very few exceptions. For example, those infective for chickens cannot infect calves, cats, or dogs but only have the ability to develop in the digestive organs of chickens. Therefore, the origin of outbreaks of coccidiosis in one kind of animal should not be blamed on another because they have been in close association. Ten species of coccidia are reported as occurring in cattle in the United States. Workers at the U.S.D.A. Regional Animal Disease Research Laboratory at Auburn, Alabama, who have been making an extensive study of the disease have studied nine of these species. These species differ from each other in the size, shape, and nature of the shell of the oocyst and in some other respects such as length of sporulation time, but they do not differ in the main as to symptoms produced. Three species have been found to be the most common cause of outbreaks of the disease. It is not unusual to find coccidial infections in cattle that do not show outward symptoms of the disease. It most commonly occurs in young animals but may develop in yearlings and older animals as well.

Symptoms—The first noticeable symptoms of coccidiosis are diarrhea, which may or may not be bloody, loss in strength, and in general condition. Affected animals become weak and emaciated very quickly and may be unable to stand or even hold up their heads. The diarrhea may have more or less blood mixed with the discharge, is usually severe, and lasts generally only five to ten days. Positive diagnosis of the disease is made by a microscopic examination of the manure and finding the organisms. Calves that survive the first week or two of the attack generally live if other complications, such as pneumonia, do not de-

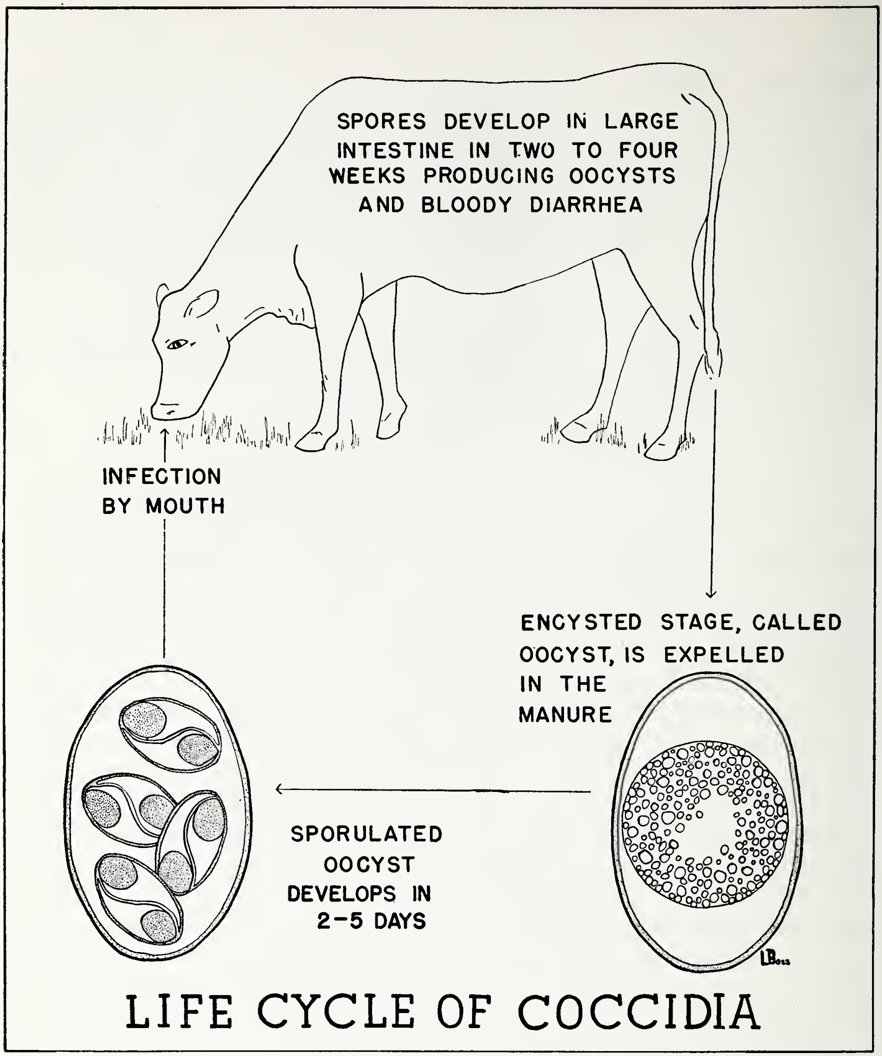
SPORES DEVELOP IN LARGE INTESTINE IN TWO TO FOUR WEEKS PRODUCING OOCYSTS AND BLOODY DIARRHEA
INFECTION BY MOUTH
ENCYSTED STAGE, CALLED OOCYST, IS EXPELLED IN THE MANURE
SPORULATED OOCYST DEVELOPS IN 2-5 DAYS
LIFE CYCLE OF COCCIDIA

FIGURE 10.

velop. The loss by death is generally not great even if the animals become very sick, but mortality as high as 50 per cent has been reported. The animals that live usually regain their strength in a surprisingly short time, though severely affected ones may remain out of good condition for months and should be given the best possible care and feed. Animals in a weakened condition from the infection have their general resistance lowered and are more susceptible to pneumonia; they should be given special protection from the weather and should not be subjected to overcrowding or be forced back from their feed by older or stronger individuals.

Life Cycle—A diagram showing the stages in the life cycle of the coccidia is shown in Figure 10. Calves become infected by having access to feed or water that has become contaminated by manure containing the infective stages of the parasites. The intestine is the region of the digestive system in which the disease develops. The infective stages are microscopic in size and enter the walls of the intestine and there multiply to such an extent that the tissues are ruptured, with the result that the blood vessels are torn open and hemorrhage follows. Inflammation of the delicate tissues, a thickening of the wall, and the general disorders of digestion and absorption manifested by diarrhea and emaciation then result. The organisms known as oocysts that develop as a result of the process of multiplication in the tissues escape into the intestine and are discharged in the manure. These oocysts are round, oval, or pear shaped, depending upon the species, and have a shell that protects them very effectively against certain unfavorable conditions of the outside world. Their internal structure consists of a single cell. At this stage they are not infective. By a series of internal divisions the single cell of the oocyst produces eight tiny cells or spores inside the original shell. This process is called sporulation, and the oocyst is said to be sporulated and is now infective. If enough of these gain access to the digestive system of a calf, they may cause coccidiosis.

Prevention—The time required for sporulation to take place varies from two to five days or more, depending on the species and environmental conditions. It is during this time that sanitary measures aimed at controlling the spread of the disease must be undertaken. When an outbreak of the disease occurs, the quarters should be thoroughly cleaned of all old manure and bedding and, if possible, cleaned every day or at least every other day for the next week or more to remove the oocysts that are passed by the affected animals before they have time to sporulate and become infective. Too much emphasis cannot be placed on immediate, thorough, and regular cleaning in the prevention of further outbreaks. In case the calves have had access to pasture or a lot, it would be well to confine the affected calves so that all the manure can be collected and disposed of to prevent further contamination of feed or pasture.

Dryness is another factor that is important in preventing the spread of coccidiosis. The oocysts do not live very long if they become dried out. If bedding has been used, it possibly would be better not to put in bedding after cleaning if an outbreak occurs, since bedding tends to hold moisture. Water should not be used in cleaning if the floors are not concrete or board or other material that will dry quickly. Moisture is a very favorable factor in the development of outbreaks of coccidiosis in cattle and chickens as well as in other animals.

It is of prime importance to prevent contamination of all feed and water with the infective stages, which are in manure. Hayracks should be so constructed that hay is not pulled out and trampled underfoot where portions may be picked up and eaten. Feed and water containers should be constructed and placed so that manure does not get into them.

While enormous numbers of oocysts are produced during the first few days of the attack, the number rapidly decreases and by the end of a week only a small percentage of the original quantity is given off. Consequently, daily cleaning can be dispensed with after six or eight days, but at least weekly cleaning should be religiously carried out for two or three months, since some oocysts are discharged for a long period and may again build up to dangerous proportions.

The use of antiseptics and disinfectants has so far proved of little value in the destruction of the oocysts because the shell prevents the penetration of these substances into the enclosed living cell. Lime scattered on the floor after cleaning has a certain amount of value in that lime absorbs moisture and in this way aids in drying out the quarters, but it cannot be depended upon to destroy the oocysts in any other way.

Effective prevention of outbreaks by the use of drugs has so far not given promise of value. In experimentally infected calves sulfaquanadine has been of some value in preventing coccidiosis. However, because of the difficulty in anticipating an outbreak of the disease, it should not be used as a substitute for sanitation.

Too much stress cannot be placed upon sanitation and management practices in preventing coccidiosis. Where the group of animals is large enough, the practice of separating the calves by age groups and having a series of pens into which each group is moved in succession has been found effective in preventing not only coccidiosis but parasitic infections as well. By this method the younger animals are not subjected to infection in the areas that may have become contaminated by older animals through constant association in a common group. A regular and effective system of cleaning all quarters of all groups is, of course, a necessary part of the program. The expense of acquiring equipment and the time required to carry out an effective sanitation and management program will be offset in a short time by increased gains in weight and prevention of losses from death not only from coccidiosis but from worm parasite infections, white scours, and pneumonia. In the end this will result in greater profits than will depending upon the use of drugs or expecting the veterinarian to bring about a cure after the animal has become sick. When animals are found to have developed the disease, it is advisable to isolate the sick individuals and give them special feed and shelter in order to prevent them from being crowded away from the feed and disturbed by the stronger individuals. This also tends to prevent the spread of the infection to other individuals.

Treatment—Up to the present time there is no known effective treatment for coccidiosis in cattle. *It should be remembered that the time of serious symptoms of the disease is so short that any treatment or anything that is done seems to do a lot of good, and as a consequence many preparations of no value have been recommended and sold for use during outbreaks in various domestic animals.* It was not until the studies of the stages of the life cycle illustrated in Figure 10 and the careful observation of the course of the disease that these treatments were found to be of no value insofar as that particular attack of the disease is concerned. This is because the infective stages of the organisms that gain entrance to the digestive tract of the calf develop at the same rate and are ready to emerge from the wall of the intestine at approximately the same time. There is then no recurrence of attacks because the oocysts pass out in the manure and must sporulate outside and then gain entrance to the calf's digestive system in order to produce a new attack of the disease. This is in contrast to such diseases as malaria, where there is a recurrence of fever and symptoms as a result of development of the malaria parasite within the blood of the infected person.

JOHNE'S DISEASE

A brief discussion of Johne's disease is included in this bulletin because of the similarity between its symptoms and those of parasitism. Johne's disease is caused by a bacterium (not by an animal parasite) which is similar to the organism causing tuberculosis and is named after one of the early students of the disease. These germs attack the wall of the large intestine where they multiply rather slowly. Thus it requires months or even years for the infection to reach sufficient proportions to cause serious symptoms. Consequently, symptoms of the disease are not usually observed in animals under two years of age (although positive diagnosis has been made in animals under six months), while symptoms of parasitism very commonly develop in animals under

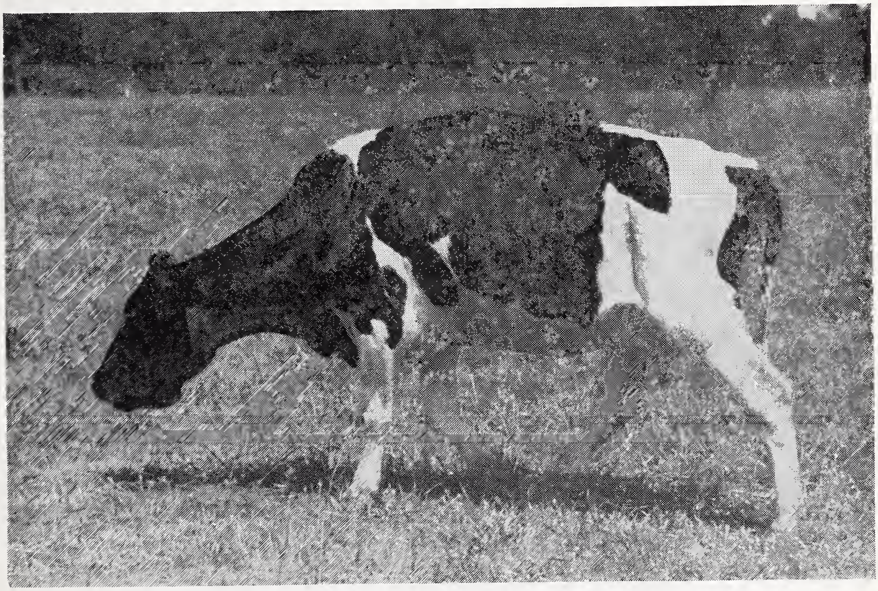

FIGURE 11.—Cow infected with Johne's disease.

one year of age. There is also a difference to be found in the intestinal wall in some cases. The wall of the large intestine of some animals infected with the organism causing Johne's disease is noticeably thickened, raised into folds, and less elastic than that of animals dead from parasitism and coccidiosis. There is much similarity in the symptoms of the two diseases. Both show emaciation, general weakness, diarrhea, and sometimes a swelling under the jaw and a watery thickening or oedema of the mesentery supporting the digestive organs. Figure 11 shows a picture of a cow with Johne's disease in the advanced stages. There is no treatment for this disease, and death is invariably the result in animals showing severe symptoms.

Johne's disease can be diagnosed by the Johnin test. This should be carried out only by an experienced veterinarian, and the Johnin developed by the U.S.D.A. preferably should be used in the test.

IMMUNITY TO PARASITIC INFECTIONS

Immunity to parasitic infections has been found by a number of investigators to develop as a result of infection with parasites. This is evidenced first by a sharp decrease in the number of eggs discharged in the feces and by a resistance to reinfection. In cattle, immunity has been observed to develop to the large stomach worm, hook worm, nodular worm, *Strongyloides papillosus, Cooperia punctata, Trichostrongylus axei,* and the lungworm. Sheep develop an immunity to *Cooperia curticei* and lungworm. Dogs become immune to the hookworm (*Ancylostoma caninum*) and cats to *Toxocara cati.* It seems highly possible that the development of immunity plays an important part in making it possible to keep older animals under conditions and on premises heavily contaminated with parasitic larvae.

The beginning of immunity is indicated by a sudden decrease in the number of eggs discharged in the manure and its continuation by the fact that when the animals are reinoculated the larvae are not allowed to develop into adults and no symptoms of infection develop. Some of these animals have been repeatedly reinoculated and some placed in a heavily contaminated pasture where nonresistant animals developed severe infections and died. Under suitable conditions of management this resistance probably lasts for a long time. In our experiments at L.S.U. three animals have remained resistant to reinfection with *Cooperia punctata* for two years. Some of the animals remained in the above mentioned pasture 3 and 4 years and still remained resistant.

Observations to date indicate that immunity to certain cattle parasites is species specific. Animals demonstrated to be resistant to *Cooperia punctata* have been infected with the nodular worm and *Trichostrongylus axei* under experimental conditions. Likewise animals immune to the nodular worm have been infected with *Trichostrongylus axei.* The same appears to be true on pasture, since two animals resistant to *Cooperia punctata* died from nodular worm infection when placed in a pasture known to be contaminated with the nodular worm.

It is most important to remember that immunity, as it applies to any specific disease-producing agent, is a matter of degree—sometimes high, sometimes low. A great many factors known and unknown account for this.

Under farm conditions it is usually difficult to determine the exact cause of the poor condition or death of animals because of the many factors that may have entered into the situation. These may include lack of feed, poor quality of feed, vitamin deficiency, and unsanitary management practices that result in bacterial and/or virus as well as parasitic infections. It is equally difficult to determine the role that the various species of parasites have had in bringing about the observed conditions. It is impossible also to determine the part immunity has had in determining the numbers of the various species found at post-mortem examinations and the numbers of eggs found in the feces, because information as to the exact extent and degree of parasitic infection preceding the time of observation is lacking.

THE IMPORTANCE OF DIAGNOSIS

The correct diagnosis of any disease condition is of prime importance. To date we have no definite diagnostic procedure for the detection of parasitism such as is available to the veterinarian for tuberculosis, Bang's disease, etc. However, *an examination of the manure by an experienced technician trained in the identification of the eggs of the worms belonging to the various species is of importance.* It will reveal the species present and degree of infection to some extent in certain animals and in the group as a whole.

The common practice of considering that animals in poor condition are heavily infected with parasites without an examination of the manure results in much labor and unnecessary use of drugs in treatment, since very often such animals have relatively few parasite eggs or the species present are those not affected by anthelmintics. *Since the efficiency of most drugs on the various species is known as the result of critical tests, the expense and labor of treatment can be saved by knowing if the species present will be effectively removed.* The presence or absence of coccidia will also be revealed by such an examination. It may also be possible to apply some of the facts of the life cycle of the particular parasites in planning the control measures.

Of equal importance is the consideration of management practices in the diagnosis of parasitism. It is sometimes said that parasites become worse in the fall and with the coming of winter. At this time of year pastures become poorer and even disappear as sources of feed. Often hay is of poor quality and a good grain concentrate is expensive. As a result the owner often trys to get by with the feed at hand with the result that the animals lose flesh and get in poor condition. Inadequate feed troughs and hay racks also influence the amount of feed and hay obtained by timid or weakened animals. *Good feed in adequate amount is the best treatment of "parasitism" in many instances.*

Post-mortem examinations are often inconclusive because of the manner in which they are carried out. A small amount of material taken from the lining of the fourth stomach or intestine for microscopic examination can be taken from an area which has only a few parasites or from the only area which has a large number. The recovery of the small species is a long and tedious process that is usually not carried out.

The exact role which the various species play as adults in producing the unthrifty condition is not well understood. Only two have been definitely incriminated as causing the loss of blood from the tissues. What food constituents of the host are used by parasites and how they obtain them is unknown. The evidence against the adults, therefore, is largely circumstantial. It has been shown, however, that the larvae produce very severe inflammation and damage to the stomach and intestinal walls, and open the way for bacteria to enter the tissues. This damage has to be slowly repaired by nature; hence the animal remains in poor condition often for months even with good care.

As a result of the above observations a most important consideration, after a definite diagnosis of parasitism has been made, is the prevention of the spread of the infection to other susceptible animals. Treatment may be carried out if it is indicated and good feed and shelter provided for the sick animals. *Prevention of infection through management is a more important consideration than the dependence on drugs to prevent further losses.*

PREVENTION

Management Practices

The prevention of losses from parasitic infections is distinctly a problem of management based on the known facts of the life cycle of the species involved. The stages of development in the life cycle may be compared to the links of a chain; and a chain, of course, is no stronger than its weakest link. When the owner has the basic information concerning the life cycle he may be able to adapt some of the details of his scheme of management so that this chain of stages may be broken and severe infections prevented. All dairymen and cattle owners will not be able to put into operation any one complete plan of management, because of the expense involved or peculiarities of individual farms. However, some procedures can ordinarily be put into operation that will reduce the parasite burden and prevent losses.

There are three factors that are of basic importance in influencing the vitality and length of life of the eggs and larvae of internal parasites and the encysted stages of coccidia. These are temperature, moisture, and time.

Of these, *temperature* is the one over which we have the least control, but it is nevertheless very important for the successful development of the larval stages. In the states bordering the Gulf of Mexico the larvae have very favorable if not ideal temperatures for development during most of the year. The hot periods in summer combined with less rainfall during some of the months no doubt cause the death of large numbers of larvae. This, however, cannot be relied upon to bring about effective control, because of the shortness of the periods of drought and the carry-over of adult parasites in already infected animals. Neither does the temperature go low enough during the winter months to cause the death of any considerable number of eggs or larvae. Realization of the small part temperature plays in the control of parasites in the Southern states serves to emphasize the importance of undertaking other measures.

Moisture is an essential factor in the life of parasitic eggs and larvae and encysted stages of coccidia and can be controlled in the selection of well-drained pastures and by modifying poor drainage of existing pastures and lots occupied by calves and young stock. Barns and shelters also should be constructed so that the floors are as dry as possible.

Time is a factor in the life of parasites because the eggs and larvae are able to withstand the various natural conditions of the environment for a limited time only. Each of the various stages of the life cycle also requires definite periods of time. Therefore, it is sometimes possible to modify management so as to prevent or reduce infection.

We may now consider the application of the above factors to management practices.

Drainage—From the standpoint of parasite control, drainage should be of first consideration in the location of lots and pastures, especially those to be occupied by calves and young stock, since they are more susceptible than adult animals. Where natural drainage is not satisfactory, ditches should be dug to remove the excess rainfall quickly. It is not desirable to have water from pastures or lots occupied by older animals drain into or across calf pastures or lots, since eggs and larvae may be washed from one to the other. Barn and shelter floors should be constructed so that they are kept dry. Cement and board floors are the most desirable and dirt, the least. The ground about the entrances should be well drained, but if it is not, a plank or cement entrance platform should be constructed.

Ponds are undesirable as sources of drinking water, because of the continuous presence of a margin of mud through which the animals must wade to drink. Manure is deposited in this mud and the larvae have favorable conditions for development and for gaining entrance to the digestive organs of animals feeding on the grass growing about the margin. The species that penetrate the skin also have favorable conditions for development and an opportunity to come in contact with the skin. Where ponds are utilized as sources of drinking water, it is very desirable to fence them and pipe the water over the side into a trough. A float valve should be put on the pipe to prevent overflow and the development of a mudhole about the trough, otherwise the purpose of the trough will be defeated.

Time—Time can be relied upon to destroy eggs, larvae, and coccidia and can be utilized in pasture rotation, barn sanitation, lot and shade sanitation, etc. Knowing how long it takes for the infective stages of the larvae to develop makes it possible at times to eliminate the source of infection by cleaning at the proper time. Barn, lot, and shade sanitation have not received the emphasis they deserve in the past, but since we know now that infection with certain species occurs through the skin, attention should be directed to this phase of control.

Barn sanitation involves cleaning the barn at regular intervals, preferably once a week, in order to prevent the accumulation of developing larvae. Where animals are showing symptoms of parasitism, weekly cleaning should be carried out in order to prevent the infection from reaching greater proportions. Weekly cleaning is important, because, as pointed out in the discussion of the various species and in the life cycle diagrams, the larvae hatch and develop to the infective stage in about a week or a little less. Thus by weekly cleaning, the eggs and the larvae are removed before they reach the infective stage. Care should be taken to remove all the manure from the corners. Water should not be used unless the floor is constructed so that it will drain and dry quickly.

Bedding is desirable but it is always necessary to keep in mind the conditions under which it is used. If cleaning is not carried out regularly and thoroughly, bedding tends to hold moisture and otherwise protect the eggs and developing larvae. In this connection it is well to consider possibilities of introducing parasitic larvae and coccidia from outside sources. If calves are confined to stalls, larvae may be introduced on the shoes or boots of the attendant if it is necessary to enter the stall to feed the animals. If the calves have access to a yard or pen in which a mild infection exists, they will infect the bedding by carrying it on their feet. If hay is used for bedding it should be cut from land that has not been grazed, because in recent experiments it has been shown that the larvae of some species remain infective at least a year on hay.

Isolation of calves in separate stalls is the most desirable method to follow in controlling all diseases. By this method infection does not spread so rapidly from individual to individual and thus is not so likely to reach serious proportions. Another method used extensively in the tropics and recommended for control of coccidiosis by workers at the Regional Animal Disease Research Laboratory at Auburn, Ala., is segregation by age groups. Animals are separated according to age and never allowed to mingle with the individuals of the older or younger groups. The following groups are suggested: (1) under 3 weeks, (2) 3-6 weeks, (3) 6 weeks to 3 months, and (4) animals over 3 months. In this system when the oldest calves reach maximum age for that group, each group is moved to the quarters of the next highest age group, which leaves the quarters of the youngest group empty to accommodate the animals to be born during the next three weeks. The advantage of this system is that the younger animals, which are more susceptible to parasite damage, are not exposed to the heavier infections of older animals in which there has been more time for large numbers of parasites to build up. Another advantage is that if an infection gets established in one group, the animals of the others are not exposed. It should be kept in mind, however, that utilization of a segregation plan does not eliminate the necessity of a system of thorough cleaning at regular intervals in order to remove any organisms that may be in the quarters. One of the cleaning times should, of course, fall on the date when the calves are changed into the quarters of the next higher age group.

Another method recommended by the Regional Animal Disease Research Laboratory at Auburn, Ala., is the use of portable pens. These are in use at the laboratory for raising animals for their experiments, and by many dairymen over the states of Alabama, Georgia, and Mississippi. The pens are made about four feet by eight feet out of light material, usually a wooden frame covered with woven fence wire. One end is closed in on the sides and top to protect the calf from bad weather. The pens are set at first preferably on the low side of sloping ground and moved up the slope to clean ground once a week. By the selection of sloping ground, any infection which may have gotten a start cannot be washed onto the areas to be used at later dates. Even though the pens are quite open and the animals are exposed to the weather, it is claimed that pneumonia and other diseases are practically eliminated because of the lack of accumulation of the disease-producing organisms as compared with tightly closed quarters of barns and sheds. Detailed information as to construction and use of these pens can be secured by writing to the Animal Disease Research Laboratory at Auburn, Ala.

Pasture Management—Since infection with most species takes place readily by mouth, the pasture must be given serious consideration in the problems of control. The problems are also likely to increase when pasture improvement is undertaken, for with improvement comes greater and better grass production which will feed more animals, and concentrating the cattle population always increases the probability of a parasite problem. One answer is pasture rotation, especially for young animals. This may be carried out by plowing under the infected topsoil and grass and planting another crop for one or two years before reseeding and using for grazing again. Rotation assumes that other ground is available in a suitable location for pasture, but if such is not the case, the pasture may be plowed in the fall and planted to oats, winter grass, or some crop that can be quickly utilized for grazing. This turns under the infected topsoil and grass to a large extent, and fresh, uncontaminated grazing plants are quickly made available. This plan is especially applicable if the original sod is Bermuda, which will quickly resod the following season.

Mowing pastures also probably helps to some extent in controlling parasites, since the taller growth is cut and animals feed on the newer growth, which has had less time to become contaminated with larvae.

Harrowing or dragging contaminated pastures possibly aids also in the destruction of larvae in that piles of manure are scattered and dry faster and thus less protection is offered to the developing larvae. Mowing and harrowing, however, has the disadvantage of scattering the manure and, at the same time, the eggs and infective larvae, thus making them more available for infection. Cattle manure from the barn should not be scattered on the pasture grazed by young stock because of the danger of introducing eggs and larvae and thus increasing the infection or adding species not already there.

It should be pointed out again that pasture sanitation alone cannot be relied upon to control parasites; the barns and shade are equally important. In some instances heavy infections develop in animals which are too young to have eaten large quantities of grass or hay and which receive their feed mostly in the form of milk and concentrates. In addition to barns the other places where calves lie down should receive attention because of the skin-penetrating species and because calves are constantly licking their coat and may in this manner acquire larvae that have gotten on the hair. Where calves are known to be infected, it would be advisable to remove the accumulations of manure from the shade areas at four- or five-day intervals.

Removing the adult worms by an effective anthelmintic reduces the number of eggs deposited in the manure and thus reduces the number of larvae which may be picked up by the animals on pasture. Treatment should be carried out a week or so before animals are transferred to a clean pasture, in order to avoid its immediate contamination. In other instances where animals are being transferred to clean quarters, pastures, or lots recently plowed, the transfer should be made after treatment in order to reduce contamination of the clean ground.

Low Level Feeding of Phenothiazine as a Means of Prevention

Controlled experiments carried out at the Agricultural Experiment Station, Louisiana State University, show that the continuous feeding of small amounts of phenothiazine should be extremely useful in preventing the buildup of infections and in the reduction of high infections on badly contaminated premises. Low level feeding exerts its effects in one of two ways. In the case of the large stomach worm and the nodular worm the drug somehow injures the female worm and egg production is stopped. However, in case of the hookworm, *C. punctata* and *T. axei*, there is no interference with egg production but the eggs do not produce infective larvae. For maximum effect, the animal must get continuously at least 1½ grams of the drug every day. Since the drug stops the supply of infective larvae of the above very common parasites of cattle, reinfection is reduced and the younger animals are protected from infection. Continuous feeding of the drug until the existing supply of larvae has been eliminated from the premises is therefore necessary. Experiments have shown that phenothiazine fed in this manner has no effect on infective larvae after they get into the animal. Calves fed the drug before and for several days following inoculation readily become infected.

No evidence has been found to indicate that there is any beneficial effect on the animals already infected or that an outbreak of acute symptoms will be stopped as a result of low level feeding of phenothiazine. It should be kept in mind that acute infections "run their course" as explained in the introduction to this bulletin. It is believed that weight gains and general improvement in condition of the animals are results of the improvement in digestion following the recovery from damage done by the larval stages. The benefits to be expected from low level feeding of phenothiazine are in the protection of the next generation of calves by the elimination of infective larvae about the pastures, lots, and barns. Likewise, there is a reduction of reinfection. Sources of infection from the outside, such as introduction of infected animals into the herd by purchase, and contaminated feed, especially hay cut from pastures grazed by infected animals, must be avoided.

In feeding the drug the owner must determine the number of pounds of grain mixture he is feeding per day to each calf and add 1½ grams of phenothiazine to this amount. Since a pound contains 453 grams, one pound of the drug would last one calf 300 days, or about 10 months. If 10 calves are being fed, one pound should be sufficient for those 10 calves for 30 days. If the animals are of such an age that they are being fed five pounds of grain a day, 50 pounds of feed would be consumed per day and 1,500 pounds in 30 days; so 1½ pounds of phenothiazine should be added to one month's supply of grain. In this manner the owner can determine the amount necessary to add to the feed in order to obtain the expected results. The above figures are on the basis of the avoirdupois pound of 16 ounces and not the apothecaries' pound of 12 ounces.

The following table will be of assistance in making up the feed mixtures:

No. lbs feed per day	Lbs. Pheno. per 100 lbs. feed	Lbs. Pheno. per 1,000 lbs. feed	Ozs. Pheno. per 100 lbs. feed
2	0.165	1.6	2.64
3	0.111	1.1	1.76
4	0.083	0.83	1.33
5	0.066	0.66	1.06

Ordinarily it will be more convenient to have the phenothiazine weighed out in the proper amount at the time of purchase.

As its action is to prevent the development of infective larvae, it should be pointed out that continuous feeding of the drug is necessary since it is effective in protecting animals against the hookworm, *Cooperia punctata*, and *Trichostrongylus axei* only while it is being fed. Although egg production of the nodular worm is stopped, continuous feeding is necessary because eggs reappear one to three months after feeding is discontinued. Continuous feeding should be carried out for at least 2 or 3 years in order to stop the contamination of the premises and allow time for the larvae already on the premises to die out. Our experiments indicate that the cost of accurately carrying out this method of feeding the drug will be small when compared to the losses should a future outbreak of parasitism occur. These observations indicate the importance of routine low level feeding as an integral part of the total management program where conditions are favorable for the development of parasitism.

TREATMENT

Treatments of various sorts have long been recommended for the removal of the adult parasites of domestic animals and man. Anthelmintics, which are drugs used for removal of parasites, are selective to a considerable degree in their action on different parasites; therefore, information as to the species with which animals are infected is useful in the choice of the drug to be used. The use of these drugs or chemicals is based upon the principle that they are more toxic or poisonous to the parasite than to the host animal to which they are administered. Some are more toxic or poisonous to the host animal than others and therefore must be given in reduced amounts if the animal is in poor condition. The amount administered must also be adjusted according to age and size of the animal. In weakened animals it is often advisable to reduce the dosage according to their condition and repeat the treatment in about two weeks. It is also strongly recommended that special care and good feed be given those individuals showing the effects of parasitism in order to build up their general resistance to other diseases.

The efficiency of the drug is affected by the fact that it is at once diluted by the contents of the digestive tract as well as acted upon by the various substances in the contents, with the result that it is rendered less effective.

Phenothiazine

Because of its efficiency against several of the species and because of its low toxicity, phenothiazine is the most satisfactory drug in use at the present time for the removal of adult parasites from cattle. It has been found to be very efficient against the large stomach worm, the nodular worm, and *Trichostrongylus axei* but not so efficient against *Cooperia, Ostertagia,* and the hookworm. It is relatively safe to administer since when given to experimental animals in quantities of two and three times the large dose of 20 grams to 100 pounds body weight recommended by some, no ill effects were observed. Experiments indicate it is not necessary to keep the animals off feed before giving the drug in order to secure the best results.

Even though the administration of this drug is relatively safe, it is desirable to secure the services of a veterinarian for the job, especially if the animals are valuable or if the number to be treated is large. However, this is not economical in many instances; in such cases it is well to consult a veterinarian and secure the necessary quantities of the drug, instruments for its administration, and advice as to dosage, restraint, etc. While the preparations sold by the various manufacturers are similar in most details, it cannot be emphasized too strongly that the directions on the label should be carefully studied and closely followed in order to avoid unfavorable results.

Administration—The most desirable method of administering any treatment is to each individual animal rather than to the group or herd. This insures that each animal receives an accurate amount of the drug and permits adjustment of the dose according to the size and physical condition of the animal. If the group is allowed access to feed to which the drug has been added, the greediest and healthiest individuals will eat faster and crowd other individuals to one side, and thus the animals that may really need the treatment the least, secure the most of the drug. The tastes of individual animals also vary and some will reject such drug feed mixtures, thus allowing other animals to eat more than their share. The best results are obtained only by individual treatment unless there are reasons that make individual handling of the animals impractical.

Phenothiazine is supplied by a number of companies furnishing veterinary supplies and may be obtained in the form of a liquid suspension, in boluses tablets, and in powder form. The liquid suspension is designed as a drench, but because of the danger of getting the material into the trachea, it is not advisable to give it from a bottle, but by means of a metal dose syringe. These are made in three sizes—2-, 4-, and 6-ounce capacity—so that the quantity to be given may be measured. They are provided with a metal tube of sufficient length so that when the tube is inserted into the mouth, the drug is deposited back of the base of the tongue in a position to be easily swallowed. The animal should be securely held and the nose raised a little higher than the back of the head and in a position so that swallowing is not interfered with. The boluses are designed to be administered with the aid of a balling gun, which places the drug back of the base of the tongue in a position to be swallowed. Care should be taken not to get it in a position to pass into the trachea.

If the drug is mixed with the feed, the animals should be fed individually if at all possible. Should group treatment be decided upon, it is highly desirable to divide the animals according to size and condition and allow the groups access to the feed separately.

Dosage—The amount of phenothiazine recommended as a dose for cattle varies between 10 and 20 grams per 100 pounds of body weight, with a maximum dose of 60 to 75 grams for grown animals. An apothecaries' ounce is equivalent to 31 grams. Dr. P. D. Harwood, who discovered the effectiveness of phenothiazine while in the U.S.D.A. Bureau of Animal Industry, recommends its administration at the rate of 10 grams per 100 pound of body weight, with a maximum dose of 60 to 75 grams. Dr. D. A. Porter of the Regional Animal Disease Research Laboratory at Auburn, Ala., recommends 20 grams to each 100 pounds of body weight, with a maximum dose of 60 grams. Since there is so much variation in the size of individuals of the same breed as well as different breeds, it would seem advisable to administer the drug according to weight rather than age in order to secure the greatest efficiency, safety, and economy.

If the liquid suspension, boluses, or tablets are obtained it is wise to follow the manufacturer's recommendations as to dosage, because products vary as to the actual amount of the drug they contain. If the powder form is obtained it is necessary to measure it in some way in order to get the proper dosage. If the powder is to be mixed with the feed, it can be measured by tablespoonfuls. Since there is much variation in the size of ordinary tablespoons, it is advisable to use one of the tablespoon measures used in the kitchen. A packed level tablespoon measure will hold between 9 and 10 grams of the powder when well packed and scraped off even across the top; when not well packed it may hold as little as 7 grams. Hence two well-packed level tablespoon measures would be approximately the maximum dose per 100 pounds body weight. Some veterinarians, as a result of their experience with the drug, recommend as low as 10 grams per 100 pounds body weight and adjust the dose to the condition of the animal.

Toxic Reactions—Toxic reactions to phenothiazine are not common, and those that do occur usually are of little consequence. However, recently treated animals should be watched in order to detect any individuals that do not respond favorably. Sometimes the eyes become sensitive to bright light, and temporary blindness results. Animals so affected should be confined to a darkened stable or dense shade until recovery. Constipation may follow in animals to which large doses have been given, and to these a cathartic should be given if necessary, although recovery usually follows spontaneously. Occasionally animals will be off feed and will be unsteady in movement for a day or so but quickly recover. The urine may be colored red for a few days owing to the excretion of the chemical, but this is no cause for alarm.

Effectiveness—Because of recent reports of the ineffectiveness of phenothiazine it seems appropriate to examine the most recent experimental results on this drug. A summary of these findings, together with the references, has been compiled in consultation with the USDA Regional Animal Disease Research Laboratory at Auburn, Ala., and the Animal Disease and Parasite Research Laboratory, U.S.D.A., Beltsville, Md. These are presented in Table 2. These results show that the drug is very effective against the large stomach worm (*Haemonchus*), the nodular worm (*Oesophagostomum radiatum*), and *Trichostrongylus axei.* It is either very variable or not effective against the other species found in cattle.

Factors which enter into the failure of the drug to control cattle parasites may be as follows:

1. *Since the drug is not 100% effective in removing all species,*

Table 2. **Effectiveness of Phenothiazine as an Anthelmintic**

Reference	*Haemonchus placei*	*Ostertagia ostertagi*	*Trichostrongylus axei*	*Cooperia punctata*	*Nematodirus helvetianus*	*Oesophagostum radiatum*	*Bunostomum phlebotomum*
Herlich, Douvres & Stewart. Vet. Med. 1954, 49:503	100% 2 animals	42-97%	100%	0-83% (all animals under 24% except 1)	....	100%	21-100%
Riek, Aust. Vet. Jour. 1951, pp. 197-202	Effective	Not Effective	T. spp. slightly or not effective	Slightly effective	....	Effective	Not effective
Sprent. Vet. Jour. 1946, 102:83-87	100%	....	....	....	....	90%	1%
Swanson, Porter and Connelly. J. Am. Vet. Med. Assn. 1940, 6:709-707	100%	80-97%	100%	1-11%	....	98-100%	24-100% (½ animals under 70%)
Porter. 1941 Proc. Helm. Soc. 8:38-41	100%	0-100% (0-57% in all but one)	90-100%	0-4.5% (0 in all but one animal)	0%	64-100%	0-15% (0% Strongyloides spp.)
Porter, Simms, Cauthen. J. Am. Vet. Med. Assn. 1941, 99:272-278	Effective	Effective?	Effective?	Not effective??	....	Effective	Effective
Mayhew, Unpublished data based on egg counts	....	....	....	0%	0%	100% effective in reducing egg counts but low counts return.	0%
Summary	Effective	Partly effective	Effective	Not effective	Not effective	Effective	Not effective

enough are left to continue contamination of premises so that the supply of infective larvae builds up to the point where damage again results.

2. The human element. Any drug should probably be as nearly as possible 100% effective under experimental conditions to be practical under farm management in order to allow for variations in administration by less experienced hands, etc.

3. Not administered frequently enough. More frequent administration by less experienced hands, etc.

4. Not administered at the most advantageous season of the year because of lack of information in regard to the environmental conditions affecting the larvae.

5. There are some who believe that smaller particle size and the purified phenothiazine is more effective. This, at present, should be considered as still in the experimental stages.

Copper Sulphate and Copper Sulphate-Nicotine Sulphate

Copper sulphate, or bluestone, has long been recommended as an anthelmintic for cattle, sheep, and goats. However, it is not considered very effective against any of the species parasitic in the digestive tract of these animals except the large stomach worm. Since recent experiments have shown that the large stomach worm is much less serious in its effect on cattle than formerly supposed, the arguments in favor of the use of this treatment have less weight. However, it is recommended and used by some. The strength usually used is a 1 per cent solution in water. This is made by dissolving ½ pound of the blue crystals of copper sulphate in 1 pint of boiling water and then adding enough water to make 3 gallons of solution. Porcelain, earthenware, or glass containers should be used in the preparation and storage of the solution, as it will corrode metal. The dose recommended is as follows: calves, 3.5 to 4 ounces; yearlings, 6 to 8 ounces; two years old and over, 16 ounces to 1 quart. A Coca-Cola bottle holds 7 ounces when full, is easily obtained, and is properly shaped for a good drench bottle. Many prefer the addition of 1 ounce of 40 per cent nicotine sulphate (Black Leaf 40) to each gallon of the 1 per cent solution of copper sulphate and believe it is more effective. The dosage is the same as for the copper sulphate solution. Animals are susceptible to poisoning with both of these preparations, and those in poor condition should have the dose reduced. Severe poisoning and death are not uncommon even in healthy animals if the amount is excessive. Animals in a weakened condition should not be given more than one-third the recommended dosage.

New Anthelmintics

There are a number of new products the anthelmintic values of which are not definitely proven at the present time. Several organic phosphate and piperazine compounds are among those being tested. The results of experiments using some of these are presented in Table 3. The use of these compounds should be considered with caution because the degree of toxicity has not been fully demonstrated.

Table 3. Effectiveness of Miscellaneous Compounds as Anthelmintics

Reference	*H. placei*	*O. ostertagi*	*T. axei*	*C. punctata*	*N. helvetianus*	*O. radiatum*	*B. phlebotomum*	Toxicity
Dow ET-57. Herlich & Johnson J. Par. 1957, 43, Sect. 2, pp. 19	98% (85-100%)	46% (23-75)	1% (0-4)	59% (42-86)	0%	30% (8-88)	....	Toxic
An organic phosphate Dowco 105. Baker, Allen. Am. J. Vet. Res. 20: 278-80	....	66%	90-100%	87% C. oneophora & punctata	....	....	....	Toxic
Piperazine citrate. Swanson, Stone, Wade. J.A.V.M.A. 1957, 130: 252-4	8-15%	71-81%	2-16%	76-98% C. spp.	56%	100%	12-34%	Not toxic
Bayer 21/199. Herlich, Porter. Vet. Med. 1958, 53: 343-7	100%	66-100%	91-100%	100%	0-93%	100%	0-100%	Toxic
Piperazine hydrate	Less than 60%	....	Less than 60%	Less than 60%	....	80-100%	Less than 60%	
Piperazine-1-carbodithoc betainc Riek and Keith. Aust. Vet. Jour. 1958; 34:1-4	Less than 60%	....	Less than 60%	80-100%	....	80-100%	....	Not toxic
N-butyl chloride. Herlich & Robrbacher. Vet. Med. 1957, 52:329	0-100%	0-25%	0%	0%	....	0%	....	Not toxic?
Neguvon (Bayer L 13/59). Riek & Keith. Aust. Vet. Jour. 1958, 34: 43-103	Very effective	....	Partly effective	Partly effective Coop. spp.	....	80-100%	Partly effective	Slightly toxic

TECHNOLOGY AND SCIENCE ROOM

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LOUISIANA BULLETIN NO. 429 JULY 1948

PRICES RECEIVED BY LOUISIANA FARMERS

1909-1947

By

J. P. MONTGOMERY

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INDEX

Page

INTRODUCTION 5

PURPOSE OF STUDY 7

DEFINITIONS 7

SOURCE OF DATA 8

METHOD OF CONSTRUCTION OF INDEXES AND RELATIVES 9

INDEXES OF PRICES RECEIVED BY FARMERS, LOUISIANA AND UNITED STATES, 1910-1947 .... 12, 13

INDEXES OF PRICES RECEIVED BY LOUISIANA FARMERS AND OF PRICES PAID BY FARMERS OF UNITED STATES, 1910-1946 14

INDEXES OF PURCHASING POWER OF LOUISIANA FARM PRODUCTS BY GROUPS, 1910-1946 15

RELATIVE PRICES RECEIVED BY LOUISIANA FARMERS FOR FORTY AGRICULTURAL PRODUCTS, 1910-1946 .... 16, 17

ALL FARM PRODUCTS 15, 18

MEAT ANIMALS 15, 19
  Beef Cattle 16, 20, 49
  Veal Calves 16, 21, 50
  Sheep 16, 22, 51
  Lambs 16, 23, 52
  Hogs 16, 24, 53

POULTRY AND EGGS 15, 25
  Chickens 16, 26, 54
  Turkeys 16, 27, 55
  Eggs 16, 28, 56

COTTON 15, 16, 29, 57

SUGAR CANE 15, 16
  For Sugar 16, 48, 71
  For Syrup 16, 48, 71

Page

FOOD GRAINS 15, 30
Rice 16, 31, 58
Cowpeas 16, 27, 55

FRUITS AND NUTS 15, 48
Oranges 16, 48, 71
Pears 16, 48, 71
Peaches 16, 48, 71
Strawberries 16, 48, 71
Pecans 16, 48, 71

FEED GRAINS AND HAY 15, 32
Corn 16, 33, 59
Oats 16, 34, 60
Hay 16, 35, 61

DAIRY PRODUCTS 15, 36
Milk (wholesale) 17, 37, 62
Milk (retail) 17, 38, 63
Butter 17, 39, 64
Butterfat 17, 40, 65

WOOL 15, 17, 41, 66

OIL BEARING CROPS 15, 42
Cottonseed 17, 43, 67
Peanuts 17, 44, 68
Soybeans 17, 44, 68

VEGETABLE AND TRUCK CROPS 15, 45
Irish Potatoes 17, 46, 69
Sweet Potatoes 17, 47, 70
Cabbage 17, 48, 71
Snapbeans (spring) 17, 48, 71
Snapbeans (fall) 17, 48, 71
Carrots 17, 48, 71
Watermelons 17, 48, 71
Onions 17, 48, 71
Green Peppers 17, 48, 71
Tomatoes 17, 48, 71
Truck Crops for Processing 17, 48, 71

Prices Received By Louisiana Farmers, 1909-1947[1]

By JOSEPH P. MONTGOMERY

This bulletin contains a wealth of data on crop and livestock prices received by Louisiana farmers since 1909. The widespread demand for the use of such data has largely developed since the end of World War I. In 1908 the United States Department of Agriculture began collecting price data by crops; however, there was no widespread interest in prices until the alarming drop in prices in 1920-21 and the economic adjustments which followed. Price movements played a prominent part in discussions of the farm problem throughout the unprecedented depression of the thirties, and the demand for price data on a local as well as a national level has continued to grow as more and more people understand their significance.

The enactment of the Agricultural Adjustment Act of 1933 aroused a more general interest in local market prices of farm products. This Act contained a clear statement of the intent of Congress to: " . . . . reestablish prices to farmers at a level that will give agricultural commodities a purchasing power with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period. The base period in the case of agricultural commodities except tobacco shall be the pre-war period, August 1909-July 1914. In the case of tobacco, the base period shall be the post war period, August 1919-July 1929." The base period for some types of tobacco was changed later to 1934-38. The Federal government calculates parity prices of various commodities for the country as a whole; however, as in the case of all national averages, the United States parity prices seldom reflect actual conditions in any given State.

The declared purpose of the Soil Conservation and Domestic Allotment Act of 1936 was the " . . . . reestablishment, at as rapid a rate as the Secretary of Agriculture determines to be practicable and in the general public interest, of the ratio between purchasing power of the net income per person on farms and the income per person not on farms that prevailed during the five-year period August 1909-July 1914, inclusive, as determined from the statistics available in the United States Department of Agriculture, and the maintenance of such ratio." This change in emphasis did not lessen interest in prices, for prices must be used with sales data in the determination of farm income and in income-parity calculations. The interest in and demand for data on prices, parity prices, and indexes of prices of farm products increased further during World War II. Farm price support programs were integral parts of the war food programs and certain guarantees were made as to prices for two years after the war. Support prices for agricultural products assured specified minimum returns per unit and were the equivalent of the contract prices for guns, ammunition, ships, tanks, clothing, and other war materials.

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[1] Some of the prices shown for the last two years in this bulletin may be revised in later releases by the Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

The chief legislation bases for the support price program are the Agricultural Adjustment Act of 1938, as supplemented by the Act of October 2, 1942, and the Steagall Amendment approved July 1, 1941, as amended October 2, 1942. Under existing laws prices must be supported for a period extending two years after the January 1 following the date on which the President, by proclamation, or Congress, by joint resolution, declares that hostilities have ended. Since the President issued that proclamation on December 31, 1946, farmers were assured price support until January 1, 1949, only, under existing law. The legislation requires that the basic crops—corn, cotton, wheat, rice, tobacco, and peanuts—be supported at 90 per cent of parity (92½ per cent in the case of cotton), if marketing quotas have not been disapproved, regardless of whether or not a support price is necessary to obtain the needed wartime production. Prices must also be supported at not less than 90 per cent of the parity or comparable price for any non-basic commodity which it was found necessary to substantially expand in production to meet the emergency. Under the legislation, lending and purchasing operations by the Federal government also were carried out to bring prices and incomes of producers of non-basic agricultural commodities not covered, to a fair parity relationship with industrial commodities.

The indexes presented in this bulletin have been prepared primarily for Louisiana conditions. Indexes of prices of farm products for the United States are inadequate in several respects for use in summarizing the price situation in Louisiana. Prices behave differently in surplus-producing areas and in deficit areas. In surplus areas prices tend to approximate the terminal market prices minus costs of delivering the product at the terminal market. Prices received by farmers for Louisiana cotton and rice fall into this class and are affected by national and international conditions of supply and demand.

On the other hand in deficit producing areas prices tend to be as much higher than in surplus producing as the cost of transportation and other necessary handling costs. For illustration, farmers who have corn for sale in Louisiana usually obtain more for it than Iowa farmers because Louisiana is a deficit corn producing state. Sales by farmers in such deficit corn producing localities are largely farm-to-farm sales. When local production of a commodity approximates a balance with local demand, prices received by farmers tend to be less sensitive to national and world market changes.

The relative importance of individual farm products varies greatly from state to state. For instance, wheat is not grown commercially in Louisiana, while it comprises more than six per cent of the total weight in the construction of the index numbers of prices of farm products in the United States. On the other hand, cotton and cottonseed comprise about 10 per cent of the total weight in the construction of the index of prices in the United States as compared with an average of 42 per cent of the total in Louisiana for the same five-year period (August 1934-July 1939).

Prices of different agricultural products do not rise or fall uniformly. Almost invariably there will be some rises and some declines among various agricultural products from one month to another. Even in periods of rapidly rising prices some products may decline in price. As a result some device for measuring the general level of prices of all farm products is needed, and this is accomplished by the construction of an all-commodity index.

Purpose of Study

The purposes of this study are: (1) to present the actual monthly, season, and average annual prices received by Louisiana farmers for each of 40 important farm products for the period August 1909 through July 1947; (2) to compile the monthly, seasonal, and annual relative prices of these important products; (3) to construct weighted aggregate index numbers of prices received by farmers for related groups of farm products; (4) to construct monthly and average annual composite weighted aggregate indexes of prices received for agricultural products by Louisiana farmers; and (5) to supply data needed to make comparisons of current prices and relative prices with the prices that have been obtained since 1909.

Definitions

Price Relative: Economic time series are often changed from absolute to relative numbers for greater ease of comparison. For instance, the average monthly prices received by Louisiana farmers for the major agricultural products from August 1909 to date are available. It is clearly much easier to compare the relative price changes by noting that the price of cotton in December 1946 was 195 per cent above its 1935-39 price than it is to compare the relationship of its absolute magnitudes. This is true particularly when one wishes to compare price behavior of commodities priced in different quantities such as pound, bushel, gallon, dozen, ton, etc.

To reduce absolute prices to relative prices, each monthly price is divided by the base price and the resulting quotient multiplied by 100 so that it may be read as a per cent of the base price. As an illustration, the average of the 60 months (August 1934-July 1939) price for cotton in Louisiana was 10.5 cents per pound as compared with a price of 36.3 cents per pound July 15, 1947—to reduce this to a relative price you divide 36.3 by 10.5 and multiply the quotient by 100 and thus determine the relative price as 346.

Index Numbers of Prices: When several time series and the values of these series are combined each month, or each year, into one composite total or average for the period, the result is an index number which reflects the typical movement of the several series which enter into it. When one single index number is computed to show the typical combined change in the prices of the several agricultural products, it is called a composite index.

Source of Data

The basic data used in the construction of the index numbers presented in this bulletin were obtained from the Louisiana Office of Agricultural Estimates, Bureau of Agricultural Economics, United States Department of Agriculture, and from releases by the Bureau of Agricultural Economics, Washington, D. C. Reference is made particularly to the following releases by the Bureau in determining the quantities of the various agricultural products sold by Louisiana farmers during the base period (1935-39): (1) Meat Animals—Farm Production and Income, 1935-42; (2) Farm Production, Disposition, and Value of Cotton and Cottonseed and Related Data, 1928-1944; (3) Farm Production, Disposition and Value of Rice, 1909-1941; (4) Sugarcane for Sugar and Syrup: Acreage, Production, and Disposition, 1909-1939; (5) Citrus Fruits: Production, Disposition, and Utilization of Sales, October 1945; (6) Prices Received by Growers for Fruit and Nut Crops, January 1945; (7) Farm Production, Disposition, and Farm Value of Corn, 1909-1941; (8) Farm Production, Disposition, and Value of Oats, 1909-1941; (9) Farm Production, Disposition, and Value of Hay, 1909-1941; (10) Farm Production, Disposition, and Income from Milk, 1935-39; (11) Peanuts—Revised Estimates—Acreage, Yield, Production, Disposition, Price, and Value, 1909-40; (12) Farm Production, Disposition and Value of Soybeans and Cowpeas, 1924-36; (13) Farm Production, Farm Disposition, and Value of Principal Field Crops, 1937-39; (14) Farm Production, Farm Disposition and Value of Principal Field Crops, 1938-40; (15) C. E. M. No. 1143-September 23, 1944; (16) F. A. No. 1378; and (17) C. E. M. No. 511.

Method of Construction

Base Period: In constructing the indexes presented here, the average of the 60 months prices, August 1934-July 1939, was used as a base. As the use of price data increased following World War I, people were interested in comparisons with pre-war conditions. Therefore, it was logical to select August 1909 through July 1914 as a base for indexes whose compilations began then. It is generally agreed that a five-year average is better than a shorter period as a base. We are now in a period following the end of another world conflict, and people generally are interested in comparisons with conditions immediately preceding the later war.

Price Series Used: The Louisiana Office of Agricultural Estimates, Bureau of Agricultural Economics, releases data each month on prices received by Louisiana farmers for various agricultural products as of the 15th of the month. Many of these price series are available in the Louisiana Office from August 1909 to date. Other products have attained importance at different times since World War I. As additional agricultural products came into prominence, Agricultural Estimates included data on them in their records. These products have been added from the time that statistical data and prices were available. For the important agricultural products marketed seasonally, the average annual prices are used in the computations. The 40 series of prices for crops, livestock and livestock products were chosen with a view to making the coverage as complete as possible because price index numbers are considered, usually, by laymen as representative of the price situation as a whole.

Weighting: Since indexes of prices should be constructed to represent the change in prices received by farmers for agricultural products, the various commodities are weighted proportionately to their importance in farmers' sales. Since as nearly a representative period as possible is desirable for the estimation of quantities sold, the average annual quantities sold during the five-year period 1935-39 were used as weights rather than a relatively shorter period, in order to adjust for annual production fluctuations due to conditions over which farmers have little or no control. The years 1935-39 were adopted because this was the latest five-year period for which complete production data were available at the beginning of the study.

Computation of Relative Prices and Index Numbers: Relative prices of the individual farm products are calculated by dividing the current monthly price by the average price for the sixty-month base period, August 1934-July 1939, and multiplying the quotient by 100.

The method of computing the group index numbers is illustrated in Table 1. The base extension of $6,262,000 for beef cattle was obtained by multiplying the average quantity sold from 1935 through 1939, or 1,376,330 units, by $4.55, the average price per unit during the price base period. The same procedure was followed for other meat animals. The sum of these extensions, $12,621,000, represents the average annual base-period value for the products included in the meat animals group. Column 4 shows the given month prices of the same products. Column 5 gives the values of the base quantities in column 1 at June 15, 1946, prices. This was obtained by multiplying the average annual quantities sold during 1935-39 by the June 15, 1946, prices. The sum of the extensions of the meat animals items was $30,813,000 for June 15, 1946. This represents the current aggregate. The index number of 244 shown in column 6 for the meat animals group for June 15, 1946, was obtained by dividing this current aggregate, $30,813,000, by the base aggregate, $12,621,000, and multiplying the quotient by 100.

Computation of the Composite Index: The method of computing the composite index number is also illustrated in Table 1. The sum of the aggregate values of the various groups shown in column 3 is $115,393,000. The sum of the aggregate values of the various groups in column 5 is $276,064,000. These two columns indicate that the same quantity of agricultural products necessary to return $115,393,000 to Louisiana farmers during the base period would have returned $276,064,000 at June 15, 1946, prices. To reduce this comparison to a composite index number of prices received by Louisiana farmers in June 1946, $276,064,000 is divided by $115,393,000 and the quotient multiplied by 100. The result

Table 1. Method of Calculation of Group and Composite Indexes of Prices Received by Louisiana Farmers (Aug. 1934—July 1939 = 100)

Commodity	Unit	(1) Quantity sold 1935-39 average	Aug. '34-July '39		Date June 15, 1946			
			(2) Simple Aver. price	(3) Extension (1x2)	(4) Aver. price	(5) Extension (1x4)	(6) Index (5÷3)	(7) Price Relative (4÷2)
		Thous. units	Dollars	Thous. dollars	Dollars	Thous. dollars	Pct.	
Meat Animals	......	......	......	12,621	......	30,813	244	......
Beef Cattle	cwt.	1,376.33	4.55	6,262	11.90	16,378	......	262
Veal calves	cwt.	145.15	5.65	820	14.00	2,032	......	248
Sheep	cwt.	21.16	3.75	79	6.60	140	......	176
Lambs	cwt.	12.48	5.30	66	10.20	127	......	192
Hogs	cwt.	898.94	6.00	5,394	13.50	12,136	......	225
Poultry and Eggs	......	......	......	2,842	......	4,991	176	......
Chickens	lb.	3,836	.153	587	.340	1,304	......	222
Turkeys	lb.	608	.193	117	.370	225	......	192
Eggs	doz.	10,183	.21	2,138	.340	3,462	......	162
Cotton	lb.	384,000	.105	40,320	.265	101,760	252	252
Sugar Cane	......	......	......	17,152	......	38,837	226	......
for Sugar	ton	5,025	3.04	15,276	6.55	32,914	......	215
Syrup	gal.	4,936	.38	1,876	1.20	5,923	......	315
Food Grains	......	......	......	14,497	......	37,619	259	......
Rice	bu.	18,467	.77	14,220	2.00	36,934	......	260
Cowpeas	bu.	163	1.70	277	4.20	685	......	247
Fruits and Nuts ..	......	......	......	5,105	......	15,848	310	......
Oranges	box	255	1.32	337	1.90	484	......	144
Pears	bu.	104	.66	69	1.50	156	......	227
Peaches	bu.	150	1.08	162	3.05	458	......	282
Strawberries	24 pt. crt.	2,332	1.67	3,874	5.20	12,126	......	311
Pecans	lb.	6,904	.096	663	.308	2,624	......	321
Feed Grains and Hay	......	......	......	1,728	......	3,529	204	......
Corn	bu.	1,736	.77	1,337	1.65	2,864	......	214
Oats	bu.	177	.50	89	1.13	200	......	226
Hay (all)	ton	31	9.73	302	15.00	465	......	154
Dairy Products	......	......	......	6,686	......	11,503	172	......
Milk (wholesale)	cwt.	1,420	2.10	2,984	4.20	5,964	......	200
Milk (retail)	qt.	32,400	.098	3,175	.140	4,536	......	143
Butter	lb.	619	.282	175	.540	334	......	191
Butterfat	lb.	1,424	.247	352	.470	669	......	190
Wool	lb.	746	.23	172	.47	351	204	204
Oil Bearing Crops	......	......	......	8,176	......	14,974	183	......
Cottonseed	ton	275	29.00	7,975	53.00	14,575	......	183
Peanuts	lb.	388	.05	19	.102	40	......	204
Soybeans	bu.	114	1.60	182	3.15	359	......	197
Vegetable and Truck	......	......	......	6,094	......	15,839	260	......
Irish potatoes	bu.	1,860	.90	1,674	1.15	2,139	......	128
Sweet potatoes	bu.	3,508	.74	2,596	2.45	8,595	......	331
Cabbage	ton	12	19.60	235	40.00	480	......	204
Snap beans (spring)	bu.	565	.92	520	2.10	1,186	......	228
Snap beans (fall)	bu.	260	.99	257	2.40	624	......	242
Carrots	bu.	267	.49	131	1.50	400	......	306
Watermelons	Thous.	1,285	109.00	140	420.00	540	......	385
Onions—50 lb. ..	sack	150	.74	111	2.20	330	......	297
Green Peppers	bu.	252	.61	154	2.20	554	......	361
Tomatoes	bu.	211	.94	198	3.50	738	......	372
Truck crops (Proc)	ton	3.6	21.60	78	70.35	253	......	326
TOTAL	......	......	......	115,393	......	276,064	239	......

Composite index—$\frac{276,064}{115,393} \times 100 = 239.23808 = 239$

is 239.238 and this is rounded to 239 and is referred to as the composite index of prices received by Louisiana farmers in June 1946.

Computation of the Index of Purchasing Power: The index of purchasing power at any given time is determined by dividing the index of prices paid by farmers into the index of prices received by farmers at the same time and multiplying the quotient by 100.

All Farm Products Index Numbers

Prices received by farmers fluctuated more widely in Louisiana during the period (1910-1946) than in the United States as a whole (Figure 1). Prices fluctuate most in surplus producing areas and in areas that are a considerable distance from large markets; they fluctuate least in areas that are deficit-producing and where there is a large volume of retail sales. When farm product prices change, distribution cost changes lag and thus absorb a decreasing proportion of rising prices and an increasing proportion of declining prices. Since Louisiana farmers devote a considerable portion of their resources to the production of such crops as cotton, sugar cane, rice, and other products sold on the world markets, prices fluctuate more in this state than they do

Indexes of Prices Received by Farmers, Louisiana and United States, 1910-1946
(August 1934—July 1939 = 100)

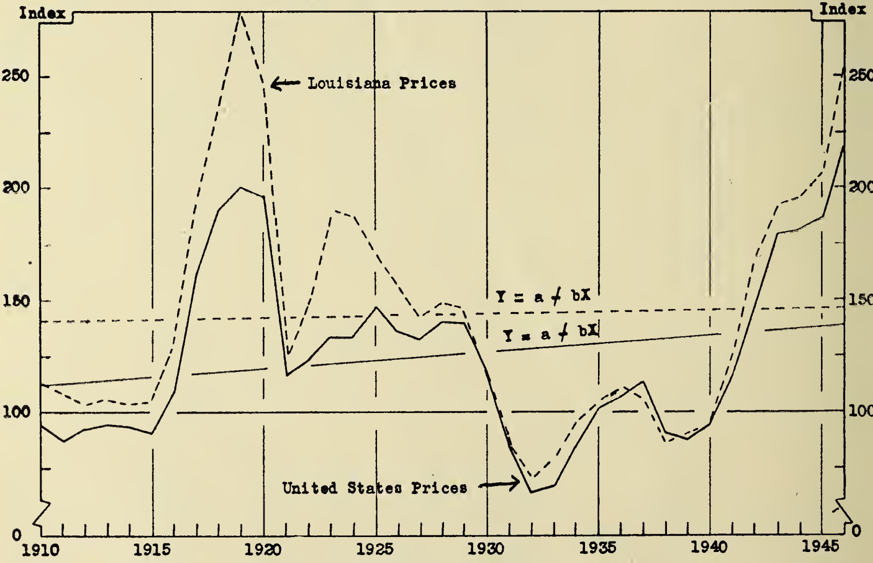

Figure 1. The index of prices received by Louisiana farmers fluctuates more widely than that for the United States, because Louisiana farmers produce surpluses of those farm products that are weighted heavily in the index of prices received by Louisiana farmers. Price movements are similar in that both tend to follow cycles.

in some other states and also more than for the United States as a whole.

During the 37 years studied, the annual indexes of prices received by Louisiana farmers were above those for the United States 35 years and below only two years. When prices rose sharply during World War I, following 1915, Louisiana farm prices attained a peak 79 points higher than the average for the United States (Figure 1). When prices for farm products fell in 1920 and 1921, those for Louisiana declined from 278 per cent of the base period (August 1934-July 1939=100) to 123 per cent, a decline of 155 points as compared with a decline of 84 points, from 199 to 115, for the United States as a whole. The following two years (1922 and 1923) prices of agricultural products rose more rapidly in Louisiana than the average for the United States. From 1924 through 1932, prices declined steadily for both Louisiana and the United States at about the same rate, reaching bottom prices in 1932 when the indexes stood at 68 for Louisiana and 63 for the United States. Since 1929 Louisiana farm products prices and the average of United States prices have tended to behave similarly. Table 2 presents comparative fluctuations in indexes of prices for Louisiana farm products and for those of the United States from 1910 through 1947.

Table 2. Indexes of Prices Received by Farmers, Louisiana and United States, 1910-1947
(August 1934—July 1939 = 100)

	Indexes of Prices Received			Indexes of Prices Received	
Year	Louisiana	United States[1]	Year	Louisiana	United States[1]
1910	113	95	1929	145	138
1911	108	87	1930	120	119
1912	103	92	1931	87	83
1913	106	95	1932	68	63
1914	103	94	1933	78	67
1915	104	92	1934	95	83
1916	129	109	1935	105	101
1917	193	162	1936	111	106
1918	235	189	1937	105	113
1919	278	199	1938	86	90
1920	245	196	1939	89	88
1921	123	115	1940	94	93
1922	151	122	1941	126	115
1923	190	133	1942	168	147
1924	188	133	1943	192	178
1925	170	145	1944	195	181
1926	157	135	1945	207	187
1927	141	132	1946	253	217
1928	148	140	1947	290	260

[1] Compiled from data published in Agricultural Prices, April 29, 1946, by the Bureau of Agricultural Economics, U. S. D. A., for the years 1910-45, and monthly issues of Agricultural Prices for 1946; and reduced to an August 1934-July 1939 base by using .927374 as a conversion factor.

The straight line trend of prices received by farmers has been upward for both Louisiana and the United States during the 37-year period, but increasing at a more rapid rate for the United States.

Prices paid by farmers do not vary from state to state as much as prices received by farmers. The index numbers of prices paid by farmers in the United States for commodities used for family maintenance and for agricultural production is the best measure available, when coupled with indexes of prices received by farmers, for determining fluctuations in the economic status of farmers. The fluctuations of prices received by Louisiana farmers are much more variable than those of prices paid by farmers in the United States (Figure 2). When the index of prices received is above the index of prices paid, farmers are in a favorable position as compared with their position during the base period (August 1934-July 1939 = 100). The straight line trend of prices received by farmers has been upward at the rate of .139 point per year, while the upward trend in prices paid by farmers has been almost five times as steep, or at an average rate of .672 point per year.

Indexes of Prices Received by Louisiana Farmers, and of Prices Paid by Farmers of the United States, 1910-1946
(August 1934—July 1939 = 100)

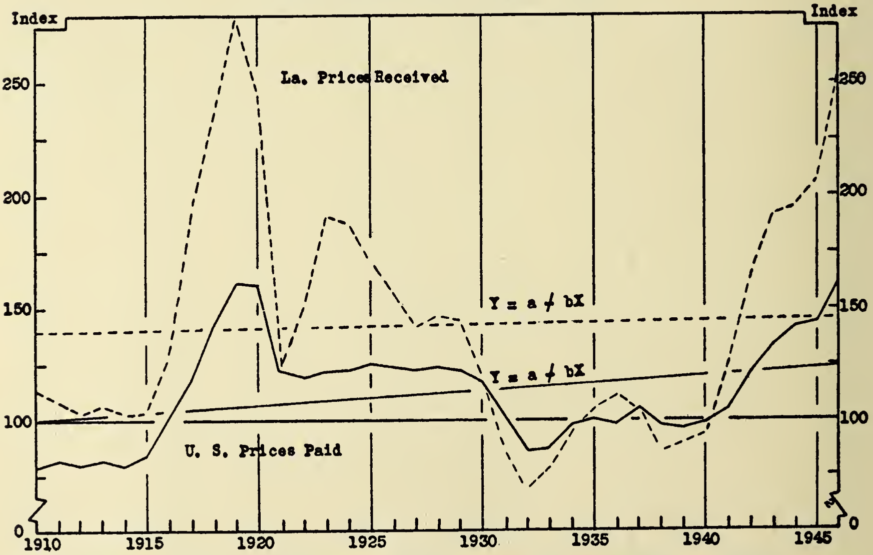

Figure 2. Prices received by farmers in Louisiana fluctuate more widely than prices paid by farmers. The long time trend is upward for both prices received and prices paid but prices paid are rising more rapidly than prices received by farmers.

Table 3. Indexes of Prices Received and Indexes of Purchasing Power by Groups of Products, Louisiana, 1910-1946

Year	Index Numbers of Prices Received by Louisiana Farmers (Aug. 1934 - July 1939 = 100)												Indexes of Prices Paid by Farmers, U. S.	Indexes of Purchasing Power of Louisiana Farm Products (1935-39 = 100)											
	All Farm Products	Meat Animals	Poultry and Eggs	Cotton	Sugar-cane	Food Grains	Fruits and Nuts	Feed Grains and Hay	Dairy Products	Wool	Oil Bear-ing Crops	Vegetables and Truck		All Farm Products	Meat Animals	Poultry and Eggs	Cotton	Sugar-cane	Food Grains	Fruits and Nuts	Feed Grains and Hay	Dairy Products	Wool	Oil Bear-ing Crops	Vegetables and Truck Crops
1910	113	99	95	133	121	93	93	98	100	91	92	91	79	143	125	120	168	153	118	118	124	127	115	116	115
1911	108	86	87	119	138	89	93	93	101	68	75	101	81	133	106	107	147	170	110	115	115	125	84	93	125
1912	103	90	90	102	121	121	74	109	101	68	64	106	80	129	112	112	128	151	151	92	136	126	85	80	132
1913	106	100	96	114	104	118	139	107	100	62	69	104	81	131	125	119	141	128	146	172	132	123	77	85	128
1914	103	113	95	98	122	109	93	111	101	64	62	104	80	129	141	119	122	152	136	116	139	126	80	78	130
1915	104	106	88	84	147	122	88	114	105	66	80	98	84	124	126	105	100	175	145	105	136	125	79	95	117
1916	129	117	105	128	171	115	79	107	104	83	140	109	99	130	118	106	129	173	116	80	108	105	84	141	110
1917	193	164	125	206	225	195	116	180	123	144	196	179	119	162	138	105	173	189	164	97	151	103	121	165	150
1918	235	190	152	279	233	254	172	218	150	192	227	187	141	167	135	108	198	165	180	122	155	106	136	161	133
1919	278	195	179	284	441	289	204	222	178	166	218	225	162	172	120	110	175	272	178	126	137	110	102	135	139
1920	245	188	199	302	196	272	215	210	193	103	186	253	161	152	117	124	188	122	169	134	130	120	64	116	157
1921	123	123	137	116	122	111	198	120	156	49	75	170	122	101	101	112	95	100	91	162	98	128	40	61	139
1922	151	104	126	177	185	127	147	110	135	64	104	147	119	127	87	106	149	155	107	124	92	113	54	87	124
1923	190	108	141	252	225	137	176	138	139	103	121	176	122	156	89	116	207	184	112	144	113	114	84	99	144
1924	188	111	144	250	176	163	202	153	137	135	128	190	122	154	91	118	205	144	134	166	125	112	111	105	156
1925	170	124	156	205	129	189	183	157	129	162	111	230	125	136	99	125	164	103	151	146	126	103	130	89	184
1926	157	130	147	140	156	170	200	137	135	132	88	196	124	127	105	119	113	126	137	161	110	109	106	71	158
1927	141	134	137	150	148	130	179	124	136	125	93	157	123	115	109	111	122	120	106	146	101	111	102	76	128
1928	148	148	143	174	124	121	176	136	136	145	123	135	124	119	119	115	140	100	98	142	110	110	117	99	109
1929	145	150	144	166	122	126	148	128	135	139	114	154	123	118	122	117	135	99	102	120	104	110	113	93	125
1930	120	129	127	116	109	122	152	125	128	107	90	151	117	103	110	109	99	93	104	130	107	109	91	77	129
1931	87	105	94	70	108	87	118	94	107	62	54	103	101	86	104	93	69	107	86	117	93	106	61	53	102
1932	68	76	73	55	99	62	77	60	81	37	32	84	87	78	87	84	63	114	71	89	69	93	43	37	97
1933	78	66	71	76	106	77	81	69	82	65	40	84	87	90	76	82	87	122	89	93	79	94	75	46	97
1934	95	71	84	113	79	103	88	95	88	91	83	89	98	97	72	86	115	81	105	90	97	90	93	85	91
1935	105	94	104	110	105	101	101	111	97	88	120	94	100	105	94	104	110	105	101	101	111	97	88	120	94
1936	111	103	105	112	119	113	109	104	101	101	117	111	99	112	104	106	113	120	114	110	105	102	102	118	112
1937	105	111	103	104	97	111	93	114	106	130	101	110	105	100	106	98	99	92	106	89	109	101	124	96	105
1938	86	101	94	78	88	83	102	82	101	93	74	87	99	87	102	95	79	89	84	103	83	102	94	75	88
1939	89	103	91	82	94	90	100	79	99	95	74	98	97	92	106	94	85	97	93	103	81	102	98	76	101
1940	94	102	92	91	90	95	105	90	105	112	81	106	98	96	104	94	93	92	97	107	92	107	114	83	108
1941	126	135	116	126	131	146	89	94	112	142	121	110	105	120	129	110	120	125	139	85	90	107	135	115	105
1942	168	181	141	177	146	214	131	118	131	164	160	137	122	138	148	116	145	120	175	107	97	107	134	131	112
1943	192	216	180	187	156	232	222	153	152	179	165	254	134	143	161	134	140	116	173	166	114	113	134	123	190
1944	195	188	171	192	168	235	275	181	158	195	175	227	141	138	133	121	136	119	167	195	128	112	138	124	161
1945	207	216	196	205	183	235	283	177	161	190	177	243	144	144	150	136	142	127	163	197	123	112	132	123	169
1946	253	263	211	273	226	265	310	204	194	206	210	250	162	156	162	130	169	140	164	191	126	120	127	130	154

Table 4. Relatives of Prices Received by Louisiana Farmers, 1910-1946
(August 1934—July 1939 = 100)

Year	Beef Cattle	Veal Calves	Sheep	Lambs	Hogs	Chickens	Turkeys	Eggs	Cotton	Sugar-cane	Syrup	Rice	Cowpeas	Oranges	Pears	Peaches	Straw-berries	Pecans	Corn	Oats	Hay
1910	88	85	109	95	113	85	......	98	133	121	116	93	......	......	......	93	......	......	93	112	115
1911	80	82	108	89	94	87	......	87	119	141	116	89	......	......	......	93	......	......	86	118	118
1912	88	85	117	94	93	85	......	91	102	123	108	121	......	......	......	74	......	......	102	120	136
1913	101	91	111	99	101	87	......	99	114	103	113	118	......	......	......	139	......	......	103	110	126
1914	116	109	132	118	110	91	......	96	98	123	113	109	......	......	......	93	......	......	107	121	129
1915	111	106	137	140	99	86	......	89	84	150	126	116	110	......	......	88	......	......	111	130	125
1916	121	117	147	130	112	81	......	99	128	174	145	116	88	......	......	79	......	......	104	118	117
1917	152	151	184	160	179	107	......	134	206	234	155	196	144	......	......	116	......	......	188	168	146
1918	167	155	214	184	222	130	......	158	279	239	179	256	160	......	......	130	172	......	224	204	202
1919	173	155	217	180	228	157	......	185	284	461	282	291	189	211	189	167	187	302	221	194	232
1920	172	154	196	169	211	170	......	207	302	189	253	273	228	132	265	250	201	323	208	220	217
1921	117	110	134	126	132	146	......	134	116	119	142	110	148	181	347	134	195	219	111	141	154
1922	95	93	109	110	116	131	140	125	177	192	129	127	132	173	259	134	129	226	104	123	133
1923	96	91	147	126	118	142	142	142	252	233	155	136	147	64	258	176	180	195	136	134	150
1924	102	99	140	124	122	145	135	144	250	184	113	163	171	130	288	171	195	274	152	135	165
1925	105	107	173	154	148	147	144	159	205	133	92	188	210	169	220	162	180	206	152	149	180
1926	102	113	156	138	155	151	160	146	140	162	108	170	195	160	197	139	208	180	125	124	187
1927	121	122	146	143	150	151	158	133	150	152	116	130	147	266	212	167	165	211	121	126	136
1928	159	164	181	173	133	151	146	141	174	127	97	121	142	189	205	148	180	145	134	141	141
1929	161	173	182	178	133	152	156	143	166	124	108	126	156	217	205	157	132	190	127	135	133
1930	125	152	156	145	129	132	122	126	116	111	95	121	165	116	197	162	153	150	124	122	130
1931	105	110	111	117	102	108	100	90	70	108	103	86	122	101	136	97	123	98	92	85	104
1932	80	77	92	82	71	81	84	71	55	101	89	62	72	97	106	97	72	86	56	61	78
1933	70	73	78	76	60	70	70	72	76	108	87	77	69	109	152	102	78	73	68	76	76
1934	68	73	79	72	68	80	78	85	113	77	97	103	99	80	83	69	83	129	97	109	86
1935	92	93	93	96	96	98	96	106	110	105	105	101	103	123	114	97	101	91	113	113	100
1936	99	95	105	111	107	106	99	107	112	122	95	113	106	123	98	102	104	127	106	94	102
1937	110	107	109	103	113	102	96	103	104	96	108	111	112	104	106	116	92	85	117	112	105
1938	102	103	102	101	100	102	95	92	78	87	97	83	90	76	76	93	105	99	79	78	99
1939	114	117	100	104	88	100	96	89	82	92	108	90	83	83	106	97	101	100	76	82	91
1940	121	120	106	104	76	100	91	90	91	88	100	95	82	76	76	93	108	101	88	90	96
1941	149	152	113	112	117	114	100	118	126	129	147	147	88	91	91	97	85	104	94	91	94
1942	184	186	143	133	178	142	121	142	177	143	171	216	119	170	98	120	123	160	120	118	108
1943	225	214	165	160	206	186	168	180	187	151	195	233	150	258	258	287	217	208	154	168	145
1944	201	200	166	160	171	185	177	166	192	168	174	236	182	197	220	278	295	194	182	198	172
1945	226	216	170	180	206	208	195	193	205	184	179	236	188	193	197	273	302	221	179	181	166
1946	263	254	180	206	266	225	198	207	273	215	315	266	215	144	227	282	311	321	212	215	169

(Continued on page 17)

Table 4. (Continued) Relatives of Prices Received by Louisiana Farmers, 1910-1946
(August 1934—July 1939 = 100)

Year	Milk (wholesale)	Milk (retail)	Butter	Butterfat	Wool	Cottonseed	Peanuts	Soybeans	Irish Potatoes	Sweet Potatoes	Cabbage	Snapbeans (spring)	Snapbeans (fall)	Carrots	Water-melons	Onions	Green Peppers	Tomatoes	Truck Crops for Processing
1910	110	93	91	107	91	92	66	......	96	88	......	......	......	......	......	......	......	......	......
1911	109	92	90	95	68	75	89	......	106	98	......	......	......	......	......	......	......	......	......
1912	148	92	99	109	68	64	78	......	110	103	......	......	......	......	......	......	......	......	......
1913	110	89	98	112	62	69	81	......	107	101	......	......	......	......	......	......	......	......	......
1914	111	91	99	106	64	62	86	......	112	98	......	......	......	......	......	......	......	......	......
1915	119	92	101	106	66	80	107	......	113	89	......	......	......	......	......	......	......	......	......
1916	118	91	103	113	83	140	92	......	140	90	......	......	......	......	......	......	......	......	......
1917	138	107	124	142	144	196	112	......	258	128	......	......	......	......	......	......	......	......	......
1918	175	124	151	175	192	228	133	......	175	173	281	245	......	......	......	216	......	......	......
1919	217	138	170	216	166	218	169	......	205	221	268	255	......	......	......	385	......	......	......
1920	226	160	178	221	103	186	179	......	308	223	205	245	......	......	......	251	......	......	......
1921	178	135	145	161	49	75	131	......	193	135	115	299	......	......	......	128	......	......	......
1922	146	123	130	155	64	104	138	......	191	116	102	174	177	......	......	204	......	......	......
1923	149	125	145	169	103	133	134	......	181	145	218	277	187	159	......	242	......	......	......
1924	143	128	160	162	135	128	124	......	161	202	249	196	187	210	......	120	213	......	......
1925	129	125	155	152	162	111	138	......	209	275	115	147	187	143	......	184	197	319	......
1926	134	133	152	160	132	87	134	......	224	178	180	234	167	143	......	158	230	191	......
1927	129	137	157	166	125	93	141	......	195	145	111	147	131	104	......	165	197	106	......
1928	131	136	154	167	145	123	149	......	130	127	118	168	157	104	......	119	148	133	284
1929	131	134	150	166	139	114	144	......	167	156	113	147	111	127	......	146	152	133	213
1930	122	131	145	143	107	90	133	......	167	158	183	114	104	102	......	155	115	117	150
1931	100	114	111	98	62	54	106	......	94	112	85	88	96	63	......	135	107	133	149
1932	69	95	82	63	37	32	78	......	86	67	135	60	61	82	......	108	139	154	110
1933	71	95	78	64	65	40	82	......	101	78	110	35	69	76	......	119	98	96	87
1934	81	96	87	76	91	83	88	......	96	96	54	78	81	65	78	68	79	74	100
1935	94	100	101	97	88	120	97	......	96	94	117	77	101	122	83	112	80	80	77
1936	101	101	104	108	101	117	99	......	133	102	94	130	91	82	92	119	79	106	98
1937	108	104	106	118	130	101	105	126	96	114	117	125	136	122	88	88	98	133	100
1938	104	99	97	93	93	73	103	84	84	93	74	76	81	82	104	97	82	64	104
1939	99	100	93	86	95	74	106	79	98	90	105	98	96	92	131	95	180	122	124
1940	109	102	96	100	112	81	103	77	102	102	122	125	66	112	143	176	131	85	111
1941	116	108	108	119	142	121	104	96	92	107	112	136	167	112	155	146	98	122	125
1942	142	119	125	137	164	160	122	135	139	120	84	152	192	163	206	119	189	191	175
1943	173	131	160	167	179	166	135	132	192	255	344	250	242	214	399	223	533	372	303
1944	180	133	162	181	195	175	167	182	176	229	143	245	247	235	459	351	311	346	275
1945	182	137	170	190	190	177	177	192	220	228	133	272	278	265	477	284	361	356	260
1946	232	154	210	222	206	210	202	180	203	258	204	228	242	306	385	297	361	372	326

Table 5. **All Farm Products:** Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	107	105	110	113	114	......
1910	117	113	113	115	115	113	113	114	110	111	112	114	113
1911	116	114	113	111	112	111	112	110	102	98	96	95	108
1912	93	97	99	104	108	104	111	107	105	100	103	107	103
1913	107	103	105	103	105	104	105	107	108	111	112	103	106
1914	107	104	103	106	109	109	112	114	102	91	86	92	103
1915	96	101	100	103	103	101	101	98	102	109	113	112	104
1916	117	120	120	123	118	122	122	130	132	140	153	153	129
1917	156	156	161	175	189	196	212	206	206	212	222	230	193
1918	233	239	247	240	236	231	230	234	241	236	229	226	235
1919	254	253	250	249	266	280	292	306	288	392	299	305	278
1920	283	280	285	287	280	285	273	249	216	187	167	149	245
1921	129	124	118	112	113	111	110	115	132	144	137	131	123
1922	141	137	141	139	144	156	158	156	151	154	169	171	151
1923	182	188	196	196	185	183	184	179	190	196	201	212	190
1924	206	204	189	194	196	191	190	190	174	174	172	177	188
1925	170	171	176	177	174	175	176	171	170	168	159	156	170
1926	162	156	154	152	152	153	150	146	150	130	127	126	157
1927	123	130	130	132	133	137	139	144	166	158	155	152	141
1928	142	141	144	146	154	152	154	150	145	148	146	147	148
1929	146	145	148	147	144	144	144	144	146	144	140	141	145
1930	138	135	129	133	131	128	119	113	108	104	103	100	120
1931	98	98	99	99	96	89	93	80	75	71	77	75	87
1932	71	70	72	68	65	61	63	68	73	70	67	65	68
1933	65	63	66	68	77	79	87	84	85	86	88	87	78
1934	85	91	93	91	89	91	83	99	104	102	103	102	95
1935	107	107	107	107	109	107	107	102	97	100	103	104	105
1936	107	106	106	108	109	109	113	116	117	115	114	116	111
1937	113	114	116	119	114	110	110	101	92	91	89	87	105
1938	85	86	86	85	87	84	86	86	85	86	87	87	86
1939	88	88	88	87	88	88	88	85	95	91	92	94	89
1940	95	92	93	89	95	93	95	93	91	93	95	95	94
1941	104	106	108	115	118	122	130	133	133	141	144	141	126
1942	161	164	168	174	172	167	168	166	167	166	168	171	168
1943	185	186	191	195	194	194	200	192	192	192	191	188	192
1944	193	195	197	197	195	193	194	192	192	197	198	198	195
1945	203	203	203	204	207	208	210	208	204	209	211	213	207
1946	222	222	228	231	235	239	260	268	273	294	280	283	253
1947	282	286	293	292	289	290	301	......	......	......	......	......	......
Average	140	141	142	143	144	144	146	145	144	146	143	143	143

Table 6. Meat Animals: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	95	98	98	95	94	......
1910	92	86	98	103	106	104	103	103	98	105	93	96	99
1911	94	91	86	89	84	82	81	81	91	87	83	89	86
1912	87	85	83	88	97	84	95	93	97	92	93	88	90
1913	87	91	95	89	105	103	103	104	105	110	111	100	100
1914	103	105	108	111	112	115	118	126	119	123	109	108	113
1915	107	108	105	108	105	107	118	103	102	107	100	104	106
1916	110	110	107	119	117	115	112	116	124	123	123	124	117
1917	121	128	137	148	160	164	172	164	176	206	191	196	164
1918	179	176	185	182	191	194	196	201	197	194	196	187	190
1919	186	189	188	189	205	191	212	215	197	199	184	190	195
1920	190	191	189	199	187	189	217	203	190	177	168	152	188
1921	148	146	144	122	126	122	115	112	118	109	117	99	123
1922	104	104	103	105	107	107	106	101	106	100	106	98	104
1923	103	107	108	107	106	102	114	112	116	112	98	105	108
1924	107	111	107	102	112	109	110	107	111	114	120	119	111
1925	118	115	130	132	125	135	124	115	114	124	131	127	124
1926	123	123	123	123	117	127	128	121	124	136	136	130	130
1927	127	135	130	130	122	126	123	138	141	143	146	141	134
1928	137	130	140	138	151	148	146	153	168	170	148	149	148
1929	150	146	149	150	151	151	152	155	148	151	149	147	150
1930	143	145	145	143	136	135	128	115	115	117	115	108	129
1931	115	111	112	114	115	105	111	106	96	90	90	94	105
1932	83	86	85	75	75	69	75	76	77	73	70	68	76
1933	60	61	62	64	73	70	70	70	65	67	68	63	66
1934	63	67	67	67	66	72	70	69	84	75	77	77	71
1935	81	83	93	92	97	97	95	94	104	93	99	102	94
1936	105	100	98	103	102	104	99	105	106	102	102	106	103
1937	104	106	104	110	110	110	115	119	118	116	112	105	111
1938	99	99	102	105	102	103	105	104	100	98	100	99	101
1939	102	101	107	106	107	104	101	99	107	106	103	96	103
1940	98	96	98	102	107	103	105	97	107	106	103	100	102
1941	109	115	115	127	133	135	147	145	153	150	146	147	135
1942	153	162	173	186	185	184	185	186	187	190	190	191	181
1943	203	214	227	235	232	232	221	215	212	208	198	189	216
1944	190	195	198	199	194	187	178	180	177	184	187	187	188
1945	203	208	212	212	221	220	222	224	224	216	212	224	216
1946	224	228	231	235	237	244	280	283	259	320	311	301	263
1947	288	302	334	334	323	330	330	......	......	......	......	......	......
Average	125	126	128	130	132	131	134	133	133	135	132	130	131

Table 7. Beef Cattle: Relative Prices Received by Louisiana Farmers, Auggust 1909—July 1947
(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	90	96	91	90	89	......
1910	86	75	79	79	99	97	97	98	94	90	77	88	88
1911	86	86	75	86	79	77	75	73	84	77	79	84	80
1912	84	81	79	88	97	84	95	92	95	88	88	84	88
1913	79	90	94	90	110	105	105	101	110	110	116	97	101
1914	103	103	112	112	116	121	121	132	116	132	110	112	116
1915	112	114	108	116	110	114	125	105	101	114	103	114	111
1916	119	119	116	130	127	119	119	119	123	121	114	121	121
1917	119	130	132	134	149	167	167	152	147	187	167	174	152
1918	163	152	156	156	163	176	187	189	171	176	165	147	167
1919	158	171	176	165	187	167	187	189	174	174	160	167	173
1920	165	176	176	191	165	169	213	193	165	165	149	141	172
1921	138	143	136	127	127	123	105	108	110	97	105	86	117
1922	99	101	92	97	99	103	101	97	94	86	90	84	95
1923	92	97	90	88	90	90	110	105	103	101	92	99	96
1924	103	105	101	94	108	101	103	94	99	103	110	101	102
1925	103	92	116	121	105	121	103	92	99	101	110	99	105
1926	101	97	99	101	99	112	97	90	103	110	110	105	102
1927	99	110	112	116	110	116	114	127	132	132	138	141	121
1928	141	136	149	143	167	165	152	165	178	189	158	163	159
1929	160	160	160	163	165	160	165	163	158	158	158	158	161
1930	154	152	149	147	136	132	121	103	103	103	101	99	125
1931	116	110	116	119	119	108	110	99	94	90	92	84	105
1932	86	92	90	77	77	77	81	79	80	77	75	71	80
1933	64	64	65	70	81	74	74	74	66	68	69	65	70
1934	66	70	70	70	71	80	74	71	85	75	78	78	68
1935	78	82	95	96	105	98	96	92	96	87	89	95	92
1936	105	99	92	105	99	103	97	99	103	95	95	101	99
1937	100	105	101	116	112	108	114	116	119	114	108	103	110
1938	102	100	104	110	105	103	105	105	97	97	97	102	102
1939	110	110	116	119	121	114	110	110	119	116	116	109	114
1940	116	114	119	125	130	125	127	112	125	125	120	114	121
1941	123	132	134	147	152	152	160	156	163	158	154	156	149
1942	163	174	182	196	191	191	182	182	187	187	187	189	184
1943	209	222	237	253	248	257	233	224	215	213	198	193	225
1944	200	213	224	220	213	207	193	191	185	187	187	189	201
1945	209	220	226	224	233	233	235	237	240	220	209	231	226
1946	229	237	244	248	250	262	290	281	257	275	292	286	263
1947	286	290	316	334	332	338	338	......	......	......	......	......	......
Average	123	125	128	131	133	133	134	130	129	130	126	125	129

Table 8. Veal Calves: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	88	90	94	85	84	......
1910	81	71	71	88	85	97	87	96	83	88	81	90	85
1911	85	83	74	74	74	74	87	80	101	83	80	90	82
1912	92	81	88	81	87	85	92	78	94	88	80	71	85
1913	67	78	85	71	106	99	97	97	88	119	101	85	91
1914	97	99	104	112	103	106	112	163	108	110	110	90	109
1915	103	104	101	110	108	106	117	104	108	106	94	106	106
1916	112	117	103	127	117	106	113	110	124	113	133	131	117
1917	124	122	154	158	168	143	161	142	154	154	166	163	151
1918	159	142	145	140	168	175	182	159	149	170	136	136	155
1919	138	145	150	152	163	152	159	166	158	165	168	147	155
1920	152	179	161	181	181	147	159	150	143	149	120	131	154
1921	129	136	131	127	122	113	101	87	94	94	81	101	110
1922	85	85	92	106	104	119	101	87	94	90	87	67	93
1923	80	90	92	90	99	92	97	96	90	92	88	88	91
1924	92	103	99	101	106	104	103	85	104	99	97	92	99
1925	92	106	106	127	112	115	104	76	94	124	124	104	107
1926	97	124	106	115	104	124	106	119	117	129	112	99	113
1927	106	124	120	104	99	119	112	129	140	142	140	129	122
1928	145	142	163	159	166	170	170	168	184	184	159	159	164
1929	170	161	173	177	188	182	177	181	172	165	166	163	173
1930	177	175	170	165	158	161	165	140	138	140	126	115	152
1931	113	108	112	119	126	108	129	115	106	97	92	90	110
1932	88	88	88	74	74	72	79	73	72	72	72	70	77
1933	72	73	69	70	85	73	78	81	77	69	68	65	73
1934	76	73	73	64	65	65	70	73	79	75	81	86	73
1935	86	86	86	88	97	101	90	92	104	87	96	104	93
1936	96	94	99	99	99	103	97	96	97	88	85	92	95
1937	103	101	101	112	113	103	104	112	115	110	110	103	107
1938	99	103	101	112	110	106	106	103	103	94	103	99	103
1939	108	110	120	122	122	122	117	113	126	119	112	108	117
1940	112	117	115	122	129	126	127	119	122	120	117	119	120
1941	126	135	136	147	152	150	159	158	165	165	175	159	152
1942	168	177	181	195	196	191	189	189	184	188	188	191	186
1943	198	209	218	230	230	239	228	214	212	205	200	191	214
1944	200	204	207	216	211	202	200	193	193	188	195	195	200
1945	209	211	214	219	219	221	221	221	218	212	211	212	216
1946	221	228	235	235	239	248	274	258	258	294	281	281	254
1947	283	301	319	326	326	336	343	......	......	......	......	......	......
Average	120	124	125	129	132	130	132	128	129	129	125	122	127

Table 9. Sheep: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	113	120	109	120	117	......
1910	112	125	128	123	115	93	93	96	120	107	133	60	109
1911	133	88	80	93	93	93	93	131	139	128	112	115	108
1912	120	125	131	128	109	107	107	80	160	101	133	101	117
1913	93	128	80	96	105	120	107	123	125	101	120	131	111
1914	123	120	96	157	136	147	131	155	120	133	131	133	132
1915	133	160	123	168	88	155	149	152	133	133	120	133	137
1916	120	147	136	149	168	133	147	147	144	144	173	155	147
1917	155	160	160	147	195	181	197	192	181	200	232	205	184
1918	200	195	221	176	235	240	251	219	213	224	213	187	214
1919	224	187	213	229	235	229	205	216	200	213	235	219	217
1920	205	192	176	197	195	235	240	208	173	176	187	168	196
1921	160	160	149	149	139	155	120	117	128	99	125	112	134
1922	125	88	83	123	139	93	115	128	107	99	123	88	109
1923	107	133	160	171	187	173	160	147	133	115	133	141	147
1924	120	128	133	139	147	133	120	133	133	149	165	187	140
1925	203	213	187	160	133	160	187	173	157	160	160	187	173
1926	205	192	179	120	123	112	109	147	200	147	181	155	156
1927	123	133	139	160	149	160	133	160	157	147	149	141	146
1928	139	139	187	160	176	187	176	187	200	213	200	211	181
1929	195	189	197	187	181	179	176	173	171	173	181	181	182
1930	184	181	171	168	149	149	139	152	163	136	133	141	156
1931	144	131	139	141	147	125	109	99	69	64	80	80	111
1932	88	107	104	99	93	88	85	91	79	83	95	93	92
1933	77	76	72	79	69	75	77	85	88	76	85	80	78
1934	87	88	80	80	77	72	71	79	76	73	81	89	79
1935	104	104	104	83	84	84	84	80	85	99	99	101	93
1936	107	107	96	101	108	108	104	107	104	109	101	108	105
1937	108	115	112	109	112	104	107	107	120	115	96	107	109
1938	107	112	99	100	100	99	107	107	101	101	101	85	102
1939	93	93	100	100	100	100	100	97	101	104	107	107	100
1940	107	112	112	107	106	104	112	107	107	100	101	96	106
1941	107	109	112	112	107	107	115	115	116	117	117	117	113
1942	123	128	128	147	160	141	141	149	149	149	149	152	143
1943	155	160	160	179	165	173	173	165	160	160	160	173	165
1944	160	165	165	173	160	168	163	157	160	173	173	173	166
1945	179	187	194	187	181	176	173	152	147	155	155	155	170
1946	155	160	160	175	176	176	197	189	195	200	187	187	180
1947	187	187	187	187	187	187	187	......	......	......	......	......	......
Average	137	139	137	140	139	139	137	138	138	134	141	137	138

Table 10. Lambs: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	87	94	96	94	87	......
1910	83	94	96	92	89	81	75	81	102	104	113	132	95
1911	100	66	66	83	104	87	91	96	108	94	89	85	89
1912	96	100	102	96	104	92	89	75	123	75	100	75	94
1913	81	96	113	94	86	102	100	94	104	113	100	108	99
1914	111	100	87	136	113	119	125	132	151	132	102	104	118
1915	106	132	100	151	98	138	147	170	166	162	157	151	140
1916	113	125	108	132	138	119	123	134	151	119	151	147	130
1917	142	151	158	157	170	164	160	170	136	151	170	164	160
1918	164	160	204	170	198	204	208	189	185	187	170	175	184
1919	179	151	170	208	213	230	196	162	143	155	170	179	180
1920	175	172	170	179	198	202	189	157	132	170	151	134	169
1921	147	158	170	119	136	136	109	96	115	102	123	98	126
1922	113	98	89	143	147	128	119	109	96	94	104	75	110
1923	94	113	85	132	142	149	153	142	132	128	125	121	126
1924	113	113	121	126	128	128	132	104	109	123	142	151	124
1925	160	170	160	151	142	151	160	142	126	132	170	179	154
1926	146	123	132	140	102	120	138	143	160	143	160	151	138
1927	138	113	151	155	143	132	113	132	149	164	179	151	143
1928	138	130	143	158	211	200	175	179	189	181	189	181	173
1929	174	172	185	170	174	183	187	189	160	179	189	179	178
1930	172	175	153	157	143	138	113	130	126	132	147	149	145
1931	140	126	113	132	138	134	126	113	98	87	98	98	117
1932	106	115	89	89	79	77	72	72	72	66	73	72	82
1933	65	71	75	77	81	82	83	83	70	73	79	79	76
1934	79	90	87	72	70	70	67	67	63	43	63	88	72
1935	104	98	94	94	85	89	81	81	81	113	113	113	96
1936	130	130	113	113	113	106	106	108	104	94	113	96	111
1937	92	98	98	100	113	106	98	109	109	109	102	102	103
1938	100	100	100	100	111	111	104	98	94	98	98	94	101
1939	94	94	102	108	108	108	108	104	106	104	104	104	104
1940	106	106	108	108	108	106	104	106	100	98	102	98	104
1941	102	100	106	108	113	113	111	113	117	117	121	126	112
1942	130	119	113	132	140	142	138	138	132	136	136	138	133
1943	138	151	153	155	147	162	181	168	160	170	170	162	160
1944	164	168	164	164	151	158	158	168	162	159	151	151	160
1945	168	177	189	185	185	185	183	181	177	174	177	177	180
1946	177	185	185	189	191	192	215	211	211	240	240	240	206
1947	232	234	243	223	228	268	268	......	......	......	......	......	......
Average	125	125	126	132	133	134	131	128	128	128	134	130	130

Table 11. Hogs: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	102	102	107	102	102	......
1910	102	100	123	133	118	113	113	112	105	120	112	105	113
1911	103	98	100	95	90	88	87	90	97	98	88	95	94
1912	90	88	85	88	98	85	95	97	100	98	100	97	93
1913	98	93	97	90	98	100	100	108	102	108	107	107	101
1914	103	108	105	108	108	108	115	113	123	113	107	105	110
1915	102	100	100	97	98	98	108	98	100	98	97	92	99
1916	100	98	97	105	105	112	103	113	113	127	132	127	112
1917	123	127	140	162	170	163	180	182	213	223	228	228	179
1918	200	210	223	218	227	218	207	222	233	218	242	242	222
1919	225	217	208	222	232	223	250	253	232	233	213	223	228
1920	225	212	208	212	213	217	230	222	227	197	197	168	211
1921	162	152	155	113	125	122	128	120	132	125	135	113	132
1922	113	112	118	113	117	108	112	108	122	118	127	120	116
1923	120	122	113	113	108	117	120	122	133	127	105	113	118
1924	115	118	115	110	117	118	118	125	127	128	133	142	122
1925	137	142	148	145	148	153	150	147	133	150	155	162	148
1926	150	152	153	150	140	145	167	157	147	167	170	163	155
1927	162	165	152	150	140	137	135	152	152	155	155	143	150
1928	132	122	125	128	128	125	135	137	153	145	133	130	133
1929	133	125	130	130	128	135	132	142	132	140	135	132	133
1930	123	132	135	133	132	133	132	123	125	130	128	117	129
1931	113	112	107	108	108	100	108	113	97	90	87	83	102
1932	78	78	78	72	72	60	67	73	73	68	65	64	71
1933	54	55	57	56	62	64	64	63	62	65	65	59	60
1934	59	61	62	63	60	64	66	66	83	76	76	75	68
1935	83	83	92	88	87	95	95	97	113	102	112	110	96
1936	107	102	103	100	105	105	102	113	110	112	113	113	107
1937	112	107	107	103	107	115	117	123	118	118	118	108	113
1938	97	97	98	98	97	102	103	103	103	100	103	95	100
1939	92	90	93	88	88	88	88	83	92	94	87	78	88
1940	74	71	71	72	78	72	76	76	82	82	82	82	76
1941	90	92	90	102	110	115	130	132	140	138	135	135	117
1942	140	148	163	175	177	177	188	192	188	195	195	195	178
1943	200	207	218	217	215	212	207	207	208	203	200	183	206
1944	177	173	167	173	170	163	157	165	167	177	182	183	171
1945	195	195	195	198	208	205	208	210	210	213	217	220	206
1946	220	220	217	220	222	225	270	292	262	378	340	323	266
1947	293	318	360	338	315	322	322	......	......	......	......	......	......
Average	127	127	128	128	130	129	134	137	138	142	136	133	133

Table 12. Poultry and Eggs: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	84	92	99	107	107	......
1910	110	99	89	85	86	86	82	86	90	101	109	116	95
1911	108	93	78	78	75	71	74	78	87	94	102	109	87
1912	113	101	85	77	74	70	78	79	87	98	107	107	90
1913	108	93	85	74	78	78	84	94	105	101	120	131	96
1914	117	102	83	79	83	84	81	83	104	102	97	124	95
1915	110	92	72	75	70	74	71	78	89	107	106	116	88
1916	117	87	76	78	74	78	78	86	98	115	124	150	105
1917	125	124	99	97	108	119	110	79	135	154	163	186	125
1918	176	170	118	125	128	119	132	143	150	169	193	199	152
1919	216	173	137	142	148	149	161	180	199	205	211	231	179
1920	246	211	167	168	168	170	168	193	189	217	224	263	199
1921	215	138	136	99	97	110	111	113	136	142	160	185	137
1922	146	134	86	97	88	107	106	115	139	145	168	181	126
1923	159	146	115	109	108	122	118	123	147	166	179	201	141
1924	174	171	112	108	113	114	116	121	146	174	168	205	144
1925	190	172	116	153	121	122	121	139	166	175	183	213	156
1926	177	148	116	113	123	124	127	132	158	170	175	198	147
1927	177	140	98	108	101	108	114	126	148	163	172	187	137
1928	179	127	121	114	114	119	127	134	154	166	178	182	143
1929	160	127	132	111	117	121	127	137	156	169	174	201	144
1930	182	159	109	113	109	110	106	110	124	130	133	142	127
1931	117	86	82	85	78	85	81	86	94	102	112	116	94
1932	98	65	52	56	53	54	53	60	80	90	100	114	73
1933	101	54	46	48	53	54	62	74	83	84	92	101	71
1934	87	97	60	61	62	69	73	76	101	103	108	124	84
1935	109	109	78	86	93	91	92	99	112	118	125	142	104
1936	112	102	85	83	84	70	95	103	115	120	131	159	105
1937	116	100	86	89	84	86	91	97	110	120	119	134	103
1938	104	80	74	78	81	81	83	91	104	111	117	130	94
1939	101	81	75	75	76	78	82	89	101	107	112	119	91
1940	97	112	71	71	76	76	78	87	97	104	111	123	92
1941	108	82	77	91	89	96	113	119	135	146	159	182	116
1942	148	120	110	118	120	126	128	130	152	170	180	194	141
1943	180	164	155	162	162	162	165	170	189	208	220	229	180
1944	217	164	152	131	139	144	144	152	171	194	215	226	171
1945	224	176	152	155	161	165	178	195	213	228	243	264	196
1946	244	192	155	160	167	176	205	219	238	249	265	262	211
1947	249	225	192	194	197	204	215	......	......	......	......	......	......
Average	148	124	101	101	102	105	109	116	132	144	153	169	125

Table 13. Chickens: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	78	78	78	81	80	......
1910	78	80	82	84	88	89	85	86	88	81	88	86	85
1911	84	85	84	86	89	88	83	86	91	92	91	90	87
1912	90	88	81	80	82	80	86	90	91	89	82	82	85
1913	85	83	82	84	84	86	95	90	89	86	89	90	87
1914	92	90	92	90	91	97	98	92	84	94	86	91	91
1915	78	82	90	90	84	86	87	82	83	81	95	88	86
1916	93	90	74	84	82	86	84	85	92	99	92	107	81
1917	95	92	95	105	105	119	110	104	122	108	114	118	107
1918	107	114	112	110	124	121	146	144	142	142	150	145	130
1919	153	144	131	121	147	154	157	176	196	170	163	170	157
1920	170	165	152	173	173	181	191	187	168	157	154	163	170
1921	163	157	161	150	137	163	150	124	144	137	138	129	146
1922	138	119	121	120	95	148	127	133	144	137	139	152	131
1923	131	124	133	124	118	150	163	137	163	163	146	148	142
1924	137	150	137	135	144	146	141	144	157	157	146	146	145
1925	144	140	139	139	162	167	147	141	148	142	150	149	147
1926	133	132	141	145	156	161	157	163	163	163	158	144	151
1927	152	148	144	156	159	156	148	150	150	149	156	144	151
1928	144	140	146	148	149	153	157	152	158	154	154	153	151
1929	150	148	146	149	159	162	158	152	152	149	151	148	152
1930	143	146	141	142	143	145	127	127	125	124	116	110	132
1931	109	106	110	117	116	120	110	105	101	99	103	97	108
1932	92	91	82	84	90	82	78	71	78	80	75	73	81
1933	69	67	64	69	75	75	73	72	72	68	69	67	70
1934	73	75	72	78	82	84	82	77	85	83	85	85	80
1935	86	87	89	98	99	103	97	94	103	101	110	111	98
1936	106	103	108	108	110	108	107	106	106	103	103	103	106
1937	100	95	98	101	103	103	100	101	107	108	103	105	102
1938	101	102	102	106	108	107	99	95	100	99	99	101	102
1939	96	95	99	104	103	103	101	100	102	102	98	95	100
1940	93	98	93	97	108	107	102	95	99	102	101	104	100
1941	98	99	102	108	115	116	118	114	120	120	125	127	114
1942	125	129	129	138	144	144	144	140	145	151	154	156	142
1943	158	167	177	197	199	196	196	189	189	191	188	188	186
1944	189	181	181	181	183	183	184	188	188	184	191	192	185
1945	191	190	194	194	203	207	217	224	224	209	216	229	208
1946	221	216	209	216	216	222	242	242	229	229	229	229	225
1947	229	229	222	233	244	250	248	......	......	......	......	......	......
Average	121	119	119	122	125	130	128	126	130	127	127	127	125

Table 14. Turkeys: Relative Prices Received by Louisiana Farmers, December 1922—July 1947 (Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1922	......	......	......	......	......	......	......	......	......	......	......	140	140
1923	155	......	......	......	......	......	......	......	......	......	135	135	142
1924	140	......	......	......	......	......	......	......	......	119	130	150	135
1925	150	......	......	......	......	......	......	......	......	140	124	161	144
1926	150	......	......	......	......	......	......	......	......	......	165	166	160
1927	150	......	......	......	......	......	......	......	......	155	166	161	158
1928	150	......	......	......	......	......	......	......	......	124	150	161	146
1929	166	......	......	......	......	......	......	......	......	145	166	145	156
1930	155	......	......	......	......	......	......	......	......	109	114	109	122
1931	119	......	......	......	......	......	......	......	......	83	98	98	100
1932	98	......	......	......	......	......	......	......	......	83	78	78	84
1933	73	67	67	67	......	......	......	......	......	73	78	67	70
1934	73	73	67	......	......	......	......	......	......	78	88	88	78
1935	88	88	88	93	......	......	......	......	......	93	109	114	96
1936	109	98	104	104	......	......	......	88	98	98	98	98	99
1937	98	93	88	93	98	98	93	93	93	98	104	104	96
1938	104	98	98	98	93	93	88	93	93	93	93	98	95
1939	98	98	98	98	98	98	88	93	93	93	93	98	96
1940	88	88	88	......	93	92	88	88	88	93	93	93	91
1941	93	93	88	93	104	93	104	98	104	98	114	119	100
1942	109	104	109	121	118	119	114	119	115	128	138	163	121
1943	155	155	155	166	166	176	171	176	166	161	176	192	168
1944	192	181	176	171	171	171	161	166	166	171	197	202	177
1945	207	192	192	181	187	187	187	202	202	197	202	207	195
1946	207	192	192	182	192	192	197	187	192	202	233	212	198
1947	202	192	192	192	192	192	192	......	......	......	......	......	......
Average	130	116	115	122	132	132	129	128	129	120	131	134	127

Table 15. Cowpeas: Relative Prices Received by Louisiana Farmers, February 1915—July 1947 (Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1915	......	115	114	121	112	109	103	109	88	126	89	126	110
1916	95	75	91	96	91	81	71	82	84	79	100	109	88
1917	109	129	129	141	165	194	155	147	150	118	144	153	144
1918	159	171	182	174	165	153	162	174	126	147	147	162	160
1919	147	159	168	171	188	235	247	229	176	194	188	171	189
1920	218	212	218	259	306	312	218	271	212	202	154	154	228
1921	151	151	142	151	147	164	169	169	141	135	131	134	148
1922	126	129	142	148	144	121	125	124	122	133	134	141	132
1923	144	138	131	141	152	154	162	176	163	142	130	135	147
1924	141	147	162	176	182	188	176	176	194	182	147	176	171
1925	176	194	206	235	247	329	153	206	212	191	194	182	210
1926	165	169	215	232	218	229	200	229	165	176	182	162	195
1927	153	159	147	165	147	147	156	144	156	132	141	118	147
1928	135	141	138	144	150	150	156	144	138	132	126	147	142
1929	144	147	150	165	176	194	182	165	129	144	147	132	156
1930	150	159	171	176	182	188	194	171	162	144	153	132	165
1931	126	121	135	144	144	141	150	129	94	88	97	94	122
1932	94	79	85	78	65	68	53	65	65	76	76	62	72
1933	59	59	62	62	68	74	79	88	76	71	68	65	69
1934	79	94	97	112	109	103	103	91	103	97	100	100	99
1935	100	109	118	126	121	124	109	100	85	85	85	79	103
1936	94	91	106	103	118	126	132	118	103	88	88	100	106
1937	112	115	118	124	132	132	121	115	100	88	88	94	112
1938	94	91	94	97	103	103	100	76	85	82	74	79	90
1939	76	85	88	91	94	97	88	88	82	74	59	74	83
1940	71	76	79	79	91	94	97	85	82	76	76	76	82
1941	79	85	88	88	88	91	91	91	85	88	88	94	88
1942	100	106	115	121	126	141	132	129	124	115	109	109	119
1943	121	135	144	147	162	168	153	159	153	153	153	150	150
1944	153	174	182	206	226	203	194	188	171	165	162	165	182
1945	168	179	188	206	212	200	206	200	176	171	176	176	188
1946	176	176	194	212	235	247	247	253	212	203	215	206	215
1947	221	206	241	271	271	282	259	......	......	......	......	......	......
Average	126	130	137	147	152	158	146	146	132	128	126	127	138

Table 16. Eggs: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	86	95	105	114	114	.....
1910	119	105	90	86	86	86	81	86	90	105	114	124	98
1911	114	95	76	76	71	67	71	76	86	95	105	114	87
1912	119	105	86	71	71	67	76	76	86	100	114	119	91
1913	116	95	86	71	76	76	81	95	110	105	129	143	99
1914	124	105	81	76	81	81	76	81	110	105	100	133	96
1915	119	95	67	71	67	71	67	76	90	114	110	124	89
1916	124	86	76	76	71	76	76	86	100	119	133	162	99
1917	133	133	100	95	110	119	110	119	138	167	176	205	134
1918	195	186	119	129	129	119	129	143	152	176	205	214	158
1919	233	181	138	148	148	148	162	181	200	214	224	248	185
1920	267	224	171	167	167	167	162	195	195	233	243	290	207
1921	229	133	129	86	86	95	100	110	133	143	167	200	134
1922	148	138	76	90	86	95	100	110	138	148	176	190	125
1923	167	152	110	105	105	114	114	119	143	167	190	219	142
1924	186	176	105	100	105	105	110	114	143	181	176	224	144
1925	205	181	110	157	110	110	114	138	171	186	195	233	159
1926	190	152	110	105	114	114	119	124	157	171	181	214	146
1927	186	138	86	95	86	95	105	119	148	167	176	200	133
1928	190	124	114	105	105	110	119	129	152	171	186	190	141
1929	162	129	129	100	105	110	119	133	157	176	181	219	143
1930	195	162	100	105	100	100	100	105	124	133	138	152	126
1931	119	81	75	77	67	75	73	81	92	104	115	122	90
1932	99	58	44	48	43	47	46	57	81	93	109	127	71
1933	111	50	40	41	47	48	59	74	86	89	100	113	72
1934	92	80	56	56	57	64	70	75	105	110	116	137	85
1935	116	116	74	83	91	88	91	100	114	124	130	151	106
1936	114	101	77	75	77	88	92	103	118	126	140	178	107
1937	121	101	83	86	78	81	88	96	112	124	125	144	103
1938	105	72	65	69	72	72	79	89	106	116	123	140	92
1939	102	76	67	66	68	70	76	86	101	109	117	127	89
1940	99	118	63	63	66	66	71	85	97	106	115	130	90
1941	110	77	69	86	81	91	112	121	141	155	170	200	118
1942	156	119	104	112	113	121	125	128	156	178	189	206	142
1943	188	164	150	152	152	152	156	165	190	215	230	243	180
1944	226	158	143	115	126	131	132	141	167	198	223	237	166
1945	233	171	138	143	148	152	167	187	210	234	252	276	193
1946	252	186	138	138	152	162	195	214	243	257	276	274	207
1947	258	226	184	183	185	191	207	......	......	......	......	......	......
Average	156	125	96	95	95	98	103	114	134	149	161	182	126

Table 17. Cotton: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	109	110	121	130	135	......
1910	137	135	133	131	133	132	131	132	130	130	135	137	133
1911	136	134	132	131	134	137	131	123	105	93	86	82	119
1912	82	88	92	100	107	109	112	110	106	103	104	114	102
1913	116	110	110	112	112	112	112	112	118	126	118	112	114
1914	111	110	110	112	112	116	117	106	86	68	63	65	98
1915	67	70	73	80	82	78	77	78	90	104	107	107	84
1916	109	109	108	109	112	116	118	128	139	151	171	170	128
1917	160	155	158	172	185	213	230	226	223	232	250	263	206
1918	278	286	295	288	267	267	270	282	296	285	269	264	279
1919	255	239	230	232	262	291	302	296	293	321	337	352	284
1920	361	356	366	374	374	371	366	324	257	202	154	124	302
1921	116	112	97	90	91	90	88	95	138	170	154	145	116
1922	145	141	145	145	155	181	192	193	187	192	217	227	177
1923	234	251	267	265	245	236	229	221	240	260	276	305	252
1924	305	295	257	276	270	257	255	257	210	210	200	207	250
1925	208	212	220	214	210	219	219	214	207	198	172	166	205
1926	168	152	151	152	150	153	144	146	158	107	101	97	140
1927	98	114	118	123	135	142	146	161	216	193	185	174	150
1928	174	162	166	172	187	184	193	179	164	170	168	170	174
1929	170	169	178	172	169	166	165	163	170	163	154	153	166
1930	152	142	130	135	135	130	111	107	93	86	89	83	116
1931	82	85	88	88	82	71	81	57	54	48	57	52	70
1932	53	53	60	54	49	43	48	60	70	64	57	52	55
1933	54	53	59	59	77	82	98	83	85	86	90	90	76
1934	93	110	112	110	105	110	116	124	126	119	118	118	113
1935	116	114	110	110	115	110	111	108	100	105	109	106	110
1936	105	105	105	107	108	108	117	117	120	117	117	119	112
1937	118	118	127	131	122	114	116	102	85	76	71	72	104
1938	73	77	79	79	80	75	78	77	79	81	80	79	78
1939	79	78	79	75	80	80	82	82	87	82	84	91	82
1940	94	93	93	92	92	89	90	88	88	90	90	88	91
1941	90	90	94	100	109	118	133	142	166	159	153	158	126
1942	173	175	176	187	183	175	177	171	176	176	176	176	177
1943	184	184	186	190	190	190	190	191	192	188	180	175	187
1944	178	184	188	190	190	190	196	194	199	200	198	195	192
1945	197	196	195	198	202	205	205	206	208	215	215	215	205
1946	220	222	231	237	245	252	287	318	336	352	286	295	273
1947	295	301	314	317	320	330	346	......	......	......	......	......	......
Average	148	148	149	151	153	154	158	156	157	155	151	151	153

Table 18. Food Grains: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	123	105	99	96	92	......
1910	108	96	88	103	100	90	94	99	81	81	84	87	93
1911	88	82	87	77	83	79	96	99	88	94	97	94	89
1912	103	117	125	130	134	125	151	125	119	94	113	119	121
1913	125	127	123	104	108	114	121	131	119	112	140	96	118
1914	109	95	78	92	110	109	119	152	136	94	96	119	109
1915	112	126	128	131	126	126	119	113	100	93	147	147	122
1916	97	117	125	128	96	117	108	137	107	111	122	117	115
1917	117	125	130	175	222	194	225	232	228	209	240	248	195
1918	253	267	291	270	299	276	249	252	243	218	213	218	254
1919	198	232	238	215	258	303	347	458	333	294	298	294	289
1920	370	358	370	339	314	350	273	224	205	169	166	130	272
1921	106	104	107	100	110	102	99	125	128	126	115	115	111
1922	144	126	140	119	114	128	140	136	106	110	140	126	127
1923	126	121	141	143	115	141	157	135	141	144	139	138	137
1924	143	144	141	146	169	176	178	172	168	167	170	183	163
1925	187	183	181	180	186	196	196	190	186	187	197	198	189
1926	199	194	186	171	179	184	190	152	153	146	145	143	170
1927	144	141	142	137	135	133	135	117	119	122	119	119	130
1928	121	116	117	120	125	128	121	120	120	118	122	124	121
1929	128	125	125	127	122	123	123	131	129	128	129	127	126
1930	130	139	134	140	139	136	130	115	104	101	100	96	122
1931	98	102	99	101	97	97	96	74	62	62	78	77	87
1932	73	69	68	64	64	62	60	61	61	55	54	53	62
1933	50	47	52	61	73	78	79	84	97	101	103	97	77
1934	101	102	104	105	101	100	98	102	101	108	110	101	103
1935	100	107	111	112	113	117	114	96	72	84	91	96	101
1936	108	110	108	109	116	116	117	118	128	113	109	106	113
1937	119	126	127	130	124	116	111	99	85	104	107	88	111
1938	94	86	82	74	76	82	83	83	78	84	89	84	90
1939	86	90	84	83	83	83	82	76	115	98	100	96	90
1940	97	89	84	84	97	97	102	102	83	91	103	107	95
1941	124	137	135	161	161	156	151	137	112	124	165	192	146
1942	203	213	229	234	234	222	219	206	206	189	200	219	214
1943	232	232	235	241	237	238	232	209	208	225	248	245	232
1944	250	253	246	247	234	226	224	214	208	236	239	243	235
1945	239	239	239	240	240	239	240	214	215	230	245	239	235
1946	239	233	252	252	259	259	259	228	255	305	320	322	265
1947	304	348	349	336	336	319	362	......	......	......	......	......	......
Average	144	145	147	147	150	152	152	149	141	139	147	146	147

Table 19. **Rice:** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	123	105	99	96	92	......
1910	108	96	88	103	100	90	94	99	81	81	84	87	93
1911	88	82	87	77	83	79	96	99	88	94	97	94	89
1912	103	117	125	130	134	125	151	125	119	94	113	119	121
1913	125	127	123	104	108	114	121	131	119	112	140	96	118
1914	109	95	78	92	110	109	119	152	136	94	96	119	109
1915	112	126	129	131	126	126	119	113	100	94	112	93	116
1916	97	118	126	129	96	118	109	138	108	112	122	117	116
1917	117	125	130	175	223	194	226	234	230	210	242	249	196
1918	255	269	294	271	301	278	251	253	245	219	214	219	256
1919	199	234	239	216	260	304	349	462	336	296	300	296	291
1920	373	361	373	340	314	350	274	223	205	166	166	130	273
1921	105	103	106	99	109	101	97	125	127	126	114	114	110
1922	144	126	140	118	113	129	140	136	105	109	140	126	127
1923	126	121	142	143	114	140	157	134	140	144	139	138	136
1924	143	144	140	145	169	175	178	171	168	166	170	183	163
1925	187	183	181	179	184	194	195	190	186	187	197	199	188
1926	200	195	186	170	178	183	190	151	153	145	144	143	170
1927	144	140	142	136	135	132	135	117	118	122	118	119	130
1928	121	116	117	119	125	127	121	119	119	118	122	123	121
1929	127	125	125	126	121	122	122	130	129	127	129	127	126
1930	130	139	134	139	138	135	129	114	103	100	99	95	121
1931	97	101	99	100	96	96	95	73	61	61	78	77	86
1932	73	69	68	64	64	62	60	61	61	55	53	53	62
1933	49	47	52	61	73	78	79	84	97	101	104	97	77
1934	101	103	104	105	101	100	97	103	101	108	110	101	103
1935	100	106	110	112	113	117	114	96	71	84	91	96	101
1936	108	110	108	109	116	116	117	118	129	113	109	106	113
1937	119	126	127	130	123	116	110	99	84	104	108	88	111
1938	94	86	82	74	75	82	83	83	78	84	90	84	83
1939	86	90	84	83	83	83	82	75	116	99	101	96	90
1940	97	90	84	84	97	97	103	103	83	91	104	108	95
1941	125	138	136	162	162	157	152	138	113	125	166	194	147
1942	205	216	231	236	236	223	221	208	208	191	201	221	216
1943	234	234	236	243	239	239	234	210	209	226	249	247	233
1944	252	255	247	248	234	226	225	214	209	238	240	244	236
1945	240	240	240	240	240	240	240	214	216	231	247	240	236
1946	240	234	253	253	260	260	260	227	256	306	322	325	266
1947	305	351	351	338	338	319	364	......	......	......	......	......	......
Average	144	146	148	147	150	152	153	149	141	139	147	145	147

Table 20. **Feed Grains and Hay:** Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	109	99	94	95	96	......
1910	98	101	102	105	106	108	106	101	94	87	83	83	98
1911	84	87	89	92	92	92	97	99	95	94	98	98	93
1912	101	104	109	116	125	126	122	116	102	94	94	100	109
1913	102	101	105	107	107	109	109	112	110	110	109	105	107
1914	105	107	109	109	113	117	118	115	115	113	105	110	111
1915	113	114	119	125	127	132	130	119	111	98	90	92	114
1916	95	98	105	108	105	103	104	108	109	109	115	127	107
1917	130	133	143	162	185	199	215	220	205	191	186	187	180
1918	192	203	224	232	226	222	221	232	228	216	212	212	218
1919	214	218	215	224	237	234	236	236	220	212	207	209	222
1920	214	224	242	254	256	253	248	224	192	160	131	127	210
1921	136	142	131	124	129	130	128	120	108	97	95	99	120
1922	94	99	109	109	107	113	119	115	112	110	112	117	110
1923	120	125	138	145	146	149	147	139	134	136	139	139	138
1924	142	143	154	148	144	144	149	161	162	168	164	157	153
1925	161	171	179	160	179	172	165	142	144	136	135	139	157
1926	157	144	141	148	146	140	143	132	132	126	123	114	137
1927	116	122	114	120	123	125	140	135	127	120	119	125	124
1928	130	133	136	136	141	150	152	141	140	122	124	124	136
1929	121	122	132	139	132	133	137	131	126	122	122	123	128
1930	121	126	127	130	128	128	122	124	128	127	119	116	125
1931	116	115	118	113	108	109	103	89	75	60	60	62	94
1932	62	61	64	60	60	62	62	60	58	57	55	56	60
1933	51	53	55	61	72	71	84	85	76	74	75	76	69
1934	79	83	87	88	89	94	95	98	104	104	107	116	95
1935	116	123	126	128	125	120	118	110	97	89	89	87	111
1936	86	89	96	95	98	94	102	119	125	117	112	119	104
1937	123	122	126	134	134	128	130	115	102	90	83	82	114
1938	86	87	88	88	90	88	88	82	76	71	69	70	82
1939	71	71	76	80	79	83	84	77	81	79	81	82	79
1940	86	92	96	94	99	96	94	91	83	81	82	81	90
1941	83	87	89	96	97	97	96	94	98	97	98	99	94
1942	103	110	116	123	124	121	122	118	117	115	118	123	118
1943	125	135	143	148	151	151	158	156	158	166	169	176	153
1944	180	184	189	186	180	183	182	177	180	176	177	179	181
1945	183	184	183	184	181	175	175	178	170	166	167	173	177
1946	169	176	182	182	194	204	239	231	215	217	220	220	204
1947	219	222	229	229	229	229	236	......	......	......	......	......	......
Average	121	124	129	131	133	134	136	132	127	122	120	122	128

Table 21. Corn: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	106	95	90	91	92	......
1910	95	96	96	100	104	106	104	96	88	82	75	75	93
1911	77	78	81	86	86	86	90	91	88	88	91	91	86
1912	92	94	97	105	119	119	119	114	96	88	88	91	102
1913	94	94	100	103	104	106	106	109	106	106	104	100	103
1914	99	100	101	103	109	116	117	112	112	109	99	106	107
1915	112	112	117	122	123	130	127	117	109	92	85	86	111
1916	88	94	101	103	100	99	101	106	108	106	114	129	104
1917	131	132	145	169	192	209	231	239	221	200	192	195	188
1918	196	205	230	238	229	226	230	244	238	221	213	212	224
1919	214	217	210	218	234	234	239	239	226	217	204	205	221
1920	208	218	244	257	258	258	252	226	192	153	119	117	208
1921	125	130	119	111	125	127	125	114	99	86	83	88	111
1922	86	91	104	104	101	106	114	110	106	105	106	110	104
1923	114	121	135	143	143	147	145	138	134	135	136	136	136
1924	140	142	156	149	143	143	149	158	161	166	164	148	152
1925	151	162	169	156	182	171	161	143	143	130	132	127	152
1926	130	130	130	138	132	130	135	117	123	119	116	104	125
1927	110	116	109	114	118	123	142	136	130	117	116	122	121
1928	125	127	132	132	139	151	153	143	143	121	123	121	134
1929	118	118	129	140	131	134	138	132	125	119	119	119	127
1930	118	123	123	130	129	127	122	125	129	127	118	116	124
1931	116	113	116	113	108	109	106	90	73	53	55	57	92
1932	57	56	58	56	56	60	60	57	53	53	49	51	56
1933	47	48	51	58	71	70	86	84	74	73	74	75	68
1934	77	84	87	90	92	96	97	100	105	104	108	119	97
1935	118	125	127	132	130	126	123	114	99	91	87	86	113
1936	84	88	94	96	96	96	105	122	129	121	116	122	106
1937	125	125	130	142	140	134	136	121	103	87	78	78	117
1938	82	82	84	90	87	87	86	81	73	65	64	64	79
1939	66	66	70	75	77	83	83	77	78	78	78	79	76
1940	83	87	92	92	97	96	95	95	83	79	81	78	88
1941	82	86	88	96	96	96	97	97	100	97	99	99	94
1942	104	110	117	125	127	125	127	123	121	117	119	123	120
1943	125	134	142	148	155	156	161	157	160	168	168	177	154
1944	178	182	188	184	183	188	187	179	182	179	177	179	182
1945	183	184	184	188	184	178	178	182	175	169	169	174	179
1946	169	177	186	186	201	214	256	245	223	227	227	227	212
1947	227	232	239	239	243	247	253	......	......	......	......	......	......
Average	117	120	125	130	132	134	137	133	127	120	117	119	126

Table 22. Oats: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	128	124	126	126	124	......
1910	120	120	126	120	116	118	118	108	104	100	100	100	112
1911	104	110	112	108	120	120	120	124	122	126	130	120	118
1912	122	128	128	136	134	130	124	116	108	104	104	104	120
1913	108	108	108	108	108	110	112	112	112	112	112	112	110
1914	116	122	120	115	116	112	116	120	128	132	128	132	121
1915	136	136	140	148	148	144	140	124	108	112	112	112	130
1916	112	116	120	120	120	116	114	116	110	112	126	136	118
1917	142	144	148	154	160	164	172	192	182	178	192	184	168
1918	168	174	202	220	220	212	216	224	216	206	202	194	204
1919	192	188	184	196	200	208	212	204	186	178	194	192	194
1920	208	240	240	232	236	238	248	234	204	212	192	156	220
1921	176	182	152	142	124	110	118	124	140	148	140	136	141
1922	124	128	130	124	112	108	116	124	128	124	128	128	123
1923	130	132	132	146	144	140	132	126	128	134	138	126	134
1924	132	132	130	122	130	130	134	120	136	140	156	162	135
1925	168	170	170	140	136	150	152	122	128	140	150	160	149
1926	130	118	126	122	120	112	120	120	122	128	140	130	124
1927	120	130	130	120	120	126	120	124	130	124	136	130	126
1928	128	134	142	154	160	162	154	138	124	128	134	130	141
1929	126	136	134	128	130	140	136	138	140	142	136	134	135
1930	138	136	130	128	130	128	112	116	114	110	108	112	122
1931	108	104	112	94	102	90	78	66	72	62	66	68	85
1932	64	64	66	64	66	62	62	60	60	54	52	56	61
1933	56	56	60	64	68	74	96	94	92	84	90	84	76
1934	88	90	100	96	96	102	96	116	116	136	146	130	109
1935	130	128	126	130	128	118	112	108	100	92	92	88	113
1936	84	92	90	80	90	70	86	102	108	100	112	114	94
1937	120	120	128	128	132	108	116	102	98	98	94	90	112
1938	86	84	84	84	82	76	76	68	74	74	76	74	78
1939	80	80	82	80	76	78	72	70	92	90	90	90	82
1940	92	100	100	100	100	86	80	80	80	84	86	86	90
1941	86	86	86	90	88	80	82	82	90	104	108	112	91
1942	112	114	120	120	120	125	110	110	112	120	120	130	118
1943	132	142	152	156	160	152	162	170	184	202	200	204	168
1944	204	206	204	198	194	196	196	194	196	192	198	196	198
1945	194	196	194	196	194	160	168	168	170	172	174	184	181
1946	184	184	184	196	206	226	248	242	232	220	230	226	215
1947	214	224	230	230	230	218	216	......	......	......	......	......	......
Average	128	131	132	131	132	129	130	129	128	129	132	130	130

Table 23. **Hay:** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	114	112	106	106	106	......
1910	108	118	124	121	114	115	115	119	118	106	112	110	115
1911	112	121	121	118	112	115	124	125	116	112	110	125	118
1912	133	144	155	157	149	139	131	125	125	117	119	137	136
1913	137	131	128	125	121	118	119	124	123	125	131	126	126
1914	128	136	139	134	128	126	126	128	129	127	124	119	129
1915	112	116	123	131	137	138	138	130	120	119	115	116	125
1916	118	110	119	126	125	118	113	113	113	118	116	116	117
1917	123	130	129	137	161	164	156	148	140	154	157	153	146
1918	182	205	205	213	219	207	187	183	191	198	212	217	202
1919	221	230	246	262	262	241	231	231	204	199	226	231	232
1920	244	244	236	248	253	236	230	215	188	176	163	166	217
1921	177	184	179	164	153	152	148	143	141	134	134	137	154
1922	125	127	128	128	134	143	140	134	133	127	133	145	133
1923	145	144	153	153	159	160	157	146	136	144	152	154	150
1924	154	154	154	149	154	154	154	185	175	185	168	195	165
1925	206	211	226	185	179	182	185	144	154	160	143	185	180
1926	199	215	194	205	216	195	185	206	175	154	153	152	187
1927	139	148	134	144	144	134	139	134	113	134	128	139	136
1928	154	159	149	147	143	145	144	134	135	125	125	135	141
1929	132	137	147	139	139	128	134	123	128	127	127	136	133
1930	131	138	143	134	123	134	123	123	133	134	123	119	130
1931	119	128	128	118	112	113	98	95	86	88	80	82	104
1932	84	83	90	76	76	72	72	72	77	77	83	79	78
1933	69	74	74	71	77	77	71	85	82	78	74	77	76
1934	85	76	84	77	72	82	83	83	98	96	92	100	86
1935	103	113	123	109	104	106	95	90	87	82	98	90	100
1936	97	91	110	96	109	90	95	110	117	108	98	106	102
1937	114	113	108	106	109	108	104	96	101	100	105	100	105
1938	103	111	104	103	106	98	102	92	92	96	88	98	99
1939	92	92	103	103	92	85	91	82	89	83	91	91	91
1940	99	110	110	103	107	98	96	79	80	96	86	92	96
1941	88	91	96	98	103	103	92	84	92	95	92	96	94
1942	99	107	113	116	111	109	103	97	105	108	110	119	108
1943	125	141	146	148	132	128	144	149	146	149	164	166	145
1944	181	190	189	188	164	158	154	164	170	157	171	172	172
1945	171	190	175	164	164	170	164	164	149	154	159	164	166
1946	164	170	164	164	159	154	165	165	176	173	185	185	169
1947	185	178	183	185	166	155	165	......	......	......	......	......	......
Average	134	140	142	139	138	135	133	130	128	127	128	133	134

Table 24. Dairy Products: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	89	96	101	104	104	......
1910	106	100	104	102	94	93	94	97	100	103	106	107	100
1911	106	105	102	96	96	91	93	96	99	101	108	109	101
1912	110	105	102	100	97	93	93	96	98	104	105	106	101
1913	107	102	99	97	92	91	94	98	101	102	108	106	100
1914	107	103	100	97	93	92	94	99	102	104	107	110	101
1915	112	110	107	104	100	95	99	100	107	108	111	111	105
1916	104	104	102	100	99	97	97	102	105	109	115	118	104
1917	119	120	118	117	116	111	115	118	126	136	140	143	123
1918	149	148	143	138	137	137	139	141	150	169	173	175	150
1919	174	170	170	170	169	168	166	169	175	196	201	203	178
1920	207	202	199	199	178	177	178	179	200	207	206	188	193
1921	183	177	165	160	154	152	150	145	148	150	144	141	156
1922	141	139	136	134	130	129	131	132	134	136	139	140	135
1923	141	144	138	136	135	133	133	131	133	141	147	151	139
1924	153	152	152	141	128	127	126	127	132	136	139	136	137
1925	134	132	131	127	120	119	120	119	133	138	139	139	129
1926	140	139	137	131	131	128	131	133	135	136	139	141	135
1927	141	139	136	134	132	131	131	132	134	138	139	139	136
1928	141	138	136	134	134	131	130	131	137	138	140	140	136
1929	142	140	139	133	130	128	128	131	134	134	136	140	135
1930	136	133	131	127	124	125	125	124	125	127	127	126	128
1931	124	117	112	109	104	101	102	103	102	104	104	102	107
1932	95	92	85	83	80	75	73	76	77	79	79	80	81
1933	80	76	75	70	70	71	83	88	89	91	94	96	82
1934	88	87	83	80	80	80	81	89	93	96	99	99	88
1935	101	104	100	97	95	92	92	93	95	97	97	100	97
1936	101	98	98	95	93	96	98	102	104	108	110	109	101
1937	110	108	107	106	104	102	103	104	105	108	109	110	106
1938	110	109	106	100	98	96	96	97	96	97	100	105	101
1939	100	99	98	97	93	93	95	96	101	104	105	108	99
1940	108	107	105	103	102	102	101	102	105	107	109	110	105
1941	109	108	106	105	106	106	106	111	120	121	125	126	112
1942	127	127	127	125	122	123	125	128	135	139	143	147	131
1943	147	148	148	151	147	150	151	152	154	156	160	160	152
1944	159	159	158	156	154	151	159	155	158	160	166	162	158
1945	162	161	161	158	158	158	159	159	161	163	164	165	161
1946	162	162	163	162	159	172	199	208	227	232	240	241	194
1947	227	238	230	218	209	204	211	......	......	......	......	......	......
Average	128	126	124	121	118	117	118	121	125	129	132	132	124

Table 25. **Milk (wholesale):** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	86	98	107	112	112	......
1910	117	117	117	114	100	98	98	102	107	112	117	119	110
1911	119	119	114	105	98	95	98	102	105	107	121	124	109
1912	124	117	112	110	105	98	98	100	102	112	114	114	148
1913	119	112	110	107	100	98	102	107	112	114	119	119	110
1914	121	114	112	107	100	98	102	107	112	114	119	124	111
1915	129	126	121	121	114	102	107	110	124	126	126	126	119
1916	114	114	114	112	112	110	107	114	119	126	136	136	118
1917	138	138	133	129	126	124	126	129	140	155	162	162	138
1918	174	174	167	157	157	157	157	160	176	207	207	207	175
1919	210	210	207	207	205	205	202	202	207	248	248	248	217
1920	248	248	245	245	200	200	198	198	240	243	243	207	226
1921	207	205	181	179	179	176	176	179	179	181	148	148	178
1922	150	148	148	145	145	143	143	143	145	148	148	148	146
1923	150	148	148	145	145	143	143	143	145	160	160	160	149
1924	164	160	160	157	136	133	131	131	133	136	138	138	143
1925	140	138	131	133	117	114	112	112	133	138	138	138	129
1926	140	136	136	131	131	129	126	129	133	136	138	138	134
1927	138	136	129	126	126	124	121	124	126	133	133	133	129
1928	136	133	129	126	126	124	121	124	136	136	138	138	131
1929	140	138	138	126	126	121	121	126	133	133	136	136	131
1930	136	129	126	117	117	114	114	114	119	124	126	126	122
1931	124	117	105	102	93	90	93	93	95	98	98	93	100
1932	88	83	69	64	64	60	60	62	64	69	71	71	69
1933	69	62	60	55	55	55	74	76	79	83	90	93	71
1934	79	79	76	69	67	67	71	83	90	95	98	98	81
1935	102	102	95	88	86	86	88	90	93	98	98	102	94
1936	102	98	98	93	88	93	93	102	107	110	112	112	101
1937	112	110	110	107	102	100	102	105	107	112	114	114	108
1938	117	114	110	102	100	98	95	98	98	100	105	114	104
1939	105	102	100	90	88	88	93	93	102	107	107	114	99
1940	114	112	110	105	102	102	102	105	110	114	117	117	109
1941	114	112	110	107	107	107	107	114	124	126	133	133	116
1942	136	140	138	133	126	126	131	138	150	157	164	169	142
1943	167	167	164	169	167	169	171	174	176	179	186	186	173
1944	183	183	181	179	176	174	174	176	181	183	186	186	180
1945	186	183	183	179	179	179	179	179	181	186	188	188	182
1946	183	183	186	183	179	200	240	260	286	290	300	300	232
1947	274	300	283	257	238	229	243	......	......	......	......	......	......
Average	138	135	131	128	123	122	124	127	134	140	143	143	133

Table 26. **Milk (retail):** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	92	94	96	96	96	......
1910	96	94	92	90	88	88	90	92	94	96	96	96	93
1911	96	94	92	90	88	88	90	92	94	96	96	94	92
1912	96	94	92	81	88	88	90	92	94	96	96	96	92
1913	94	92	87	86	84	84	86	90	90	90	97	92	89
1914	92	92	90	88	86	86	86	90	92	94	96	96	91
1915	96	94	94	87	86	88	92	92	92	92	97	96	92
1916	94	94	90	88	86	84	87	90	92	92	94	100	91
1917	100	100	100	102	104	97	102	107	110	117	118	122	107
1918	122	122	120	120	117	117	120	120	122	131	135	139	124
1919	135	131	131	131	131	131	131	135	143	145	143	155	138
1920	165	155	153	153	153	153	158	159	161	173	171	165	160
1921	155	151	149	141	133	133	131	117	120	120	138	131	135
1922	129	128	124	120	114	114	120	122	124	124	128	129	123
1923	129	138	124	122	120	120	120	116	118	120	132	139	125
1924	140	141	143	122	115	116	118	118	126	133	136	130	128
1925	124	123	122	116	116	117	122	122	131	135	137	137	125
1926	137	139	135	129	129	122	133	134	135	135	135	137	133
1927	139	139	139	136	135	135	136	136	137	137	139	139	137
1928	139	139	139	137	136	133	133	133	134	136	139	139	136
1929	140	137	136	136	130	129	129	131	131	131	133	142	134
1930	135	134	133	133	127	133	133	131	129	127	127	126	131
1931	126	119	119	115	115	112	112	112	110	110	110	108	114
1932	103	102	102	102	98	92	87	91	91	91	90	90	95
1933	92	92	92	86	86	84	94	102	102	102	102	102	95
1934	100	98	92	92	94	93	92	96	97	97	101	101	96
1935	101	104	105	103	103	97	96	96	97	97	97	98	100
1936	98	97	97	97	97	100	100	100	100	107	107	107	101
1937	107	105	104	104	104	102	103	103	103	102	103	105	104
1938	105	105	102	98	98	96	97	98	96	96	97	98	99
1939	98	98	98	98	98	99	100	101	102	103	104	104	100
1940	103	103	101	103	102	102	101	101	102	102	104	104	102
1941	104	104	103	103	103	103	104	106	116	116	116	117	108
1942	119	115	116	116	117	119	119	119	121	121	123	126	119
1943	127	129	131	132	127	131	131	131	132	133	133	133	131
1944	133	133	133	133	131	128	133	134	134	135	135	136	133
1945	136	136	136	136	135	135	136	137	138	138	138	139	137
1946	139	139	139	139	139	143	155	156	166	173	179	179	154
1947	179	179	179	178	178	178	179	......	......	......	......	......	......
Average	117	116	115	113	111	111	113	114	116	117	120	120	115

Table 27. **Butter:** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	85	85	92	92	92	......
1910	92	96	96	92	92	92	87	89	85	85	92	92	91
1911	92	92	92	89	89	89	85	85	92	92	92	96	90
1912	103	103	99	99	99	92	92	96	96	99	103	106	99
1913	99	99	99	96	99	99	99	99	96	99	99	99	98
1914	99	99	99	99	99	99	99	99	99	99	99	99	99
1915	103	103	99	99	99	99	99	99	99	103	103	106	101
1916	103	99	99	99	99	103	103	103	99	106	113	113	103
1917	117	117	117	121	121	121	121	121	121	128	135	145	124
1918	160	156	142	135	135	135	138	142	149	163	170	184	151
1919	184	170	163	170	181	163	149	156	156	163	184	199	170
1920	191	177	181	177	170	170	170	170	177	184	181	191	178
1921	184	163	156	156	142	128	121	128	135	142	142	142	145
1922	145	135	128	131	128	121	121	121	121	128	135	142	130
1923	142	138	142	142	142	142	135	142	145	149	156	160	145
1924	167	177	163	156	163	149	145	156	160	156	156	170	160
1925	149	142	145	160	160	156	149	145	160	156	166	167	155
1926	152	156	152	149	149	160	145	145	149	149	160	163	152
1927	160	163	152	160	149	152	152	152	160	160	156	167	157
1928	160	156	156	156	156	152	145	149	149	156	152	156	154
1929	145	149	149	152	149	145	149	152	152	152	160	149	150
1930	149	149	149	149	149	145	142	142	138	145	145	135	145
1931	128	121	121	117	113	106	103	99	103	106	103	113	111
1932	103	92	89	89	78	74	74	78	78	78	74	78	82
1933	78	74	71	74	74	78	82	78	78	82	85	85	78
1934	82	85	85	82	82	85	82	85	92	92	96	96	87
1935	99	110	103	103	99	96	96	99	99	99	106	106	101
1936	110	103	103	96	96	96	103	106	103	106	110	113	104
1937	110	103	106	106	106	103	103	103	103	106	110	110	106
1938	106	99	99	99	96	89	89	96	96	99	99	99	97
1939	96	96	92	92	92	92	89	85	92	96	96	96	93
1940	96	96	92	92	96	92	96	96	96	96	96	103	96
1941	103	103	99	99	103	103	110	106	113	113	131	124	108
1942	121	117	117	121	121	121	120	121	128	131	135	149	125
1943	149	156	156	156	156	160	160	160	160	163	170	170	160
1944	167	167	163	163	163	156	156	156	160	160	163	174	162
1945	170	167	167	167	167	167	170	170	170	174	177	177	170
1946	181	181	181	181	181	191	230	230	223	230	252	259	210
1947	241	227	227	223	220	209	213	......	......	......	......	......	......
Average	130	127	125	125	124	122	122	123	125	128	132	136	127

Table 28. Butterfat: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	97	101	101	113	117	......
1910	117	109	113	109	101	101	101	105	105	109	113	105	107
1911	101	97	89	81	77	81	89	89	93	105	117	126	95
1912	130	117	117	113	105	97	93	97	101	105	113	121	109
1913	121	121	126	113	105	101	97	101	113	113	117	121	112
1914	117	109	101	93	97	97	101	105	109	113	117	117	106
1915	117	113	105	109	101	101	97	89	97	105	113	121	106
1916	113	117	117	109	101	101	101	105	109	117	134	134	113
1917	138	142	146	146	134	130	130	134	142	146	150	162	142
1918	170	166	154	146	150	150	154	166	182	202	227	235	175
1919	223	198	210	219	198	190	190	198	211	239	256	259	216
1920	247	243	239	227	219	198	194	202	211	219	223	235	221
1921	231	178	178	178	150	130	126	121	142	162	162	170	161
1922	170	166	150	158	150	142	142	142	142	154	170	174	155
1923	178	178	182	174	170	154	154	158	162	166	170	178	169
1924	178	170	166	162	158	154	150	154	162	162	162	166	162
1925	162	154	154	154	154	150	146	142	146	150	154	162	152
1926	162	158	154	154	154	154	158	158	154	154	170	194	160
1927	170	154	158	170	154	158	162	154	170	178	186	174	166
1928	190	170	158	162	166	174	166	162	170	162	170	158	167
1929	166	174	178	162	166	166	162	170	166	170	159	158	166
1930	154	154	146	146	154	138	146	142	142	142	130	126	143
1931	113	97	109	101	93	93	93	101	93	97	109	85	98
1932	81	77	69	69	61	57	57	57	57	57	57	57	63
1933	61	61	61	61	61	65	69	65	65	69	65	65	64
1934	61	69	69	69	73	73	73	73	77	89	93	89	76
1935	93	113	101	113	101	97	89	89	89	89	89	97	97
1936	105	105	105	105	89	97	117	121	117	109	113	109	108
1937	126	121	121	113	109	113	113	113	113	121	126	126	118
1938	109	109	109	97	85	89	89	89	85	85	85	89	93
1939	85	85	85	81	85	85	81	81	85	85	93	97	86
1940	105	105	97	97	97	97	97	97	101	101	101	109	100
1941	105	105	105	105	121	121	121	121	126	126	134	138	119
1942	134	130	130	130	134	134	134	134	138	142	146	162	137
1943	166	166	162	162	162	158	159	166	166	174	182	182	167
1944	182	182	182	182	178	174	174	174	182	182	190	190	181
1945	190	190	190	186	186	186	190	190	190	194	194	194	190
1946	190	190	190	190	190	190	223	223	231	263	287	296	222
1947	263	247	247	247	239	227	227	......	......	......	......	......	......
Average	142	138	136	134	129	127	128	129	134	139	145	148	136

Table 29. **Wool:** Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	100	104	104	104	104	......
1910	100	104	96	87	109	96	100	91	70	83	78	74	91
1911	61	78	74	78	74	61	61	65	74	65	65	65	68
1912	65	65	70	61	65	74	70	70	78	70	65	57	68
1913	70	65	57	65	56	52	65	65	65	65	57	61	62
1914	65	61	61	61	43	69	70	65	74	78	61	61	64
1915	70	61	65	70	61	70	65	74	57	74	61	70	66
1916	74	78	61	69	100	109	87	96	87	78	78	78	83
1917	74	83	96	117	130	165	195	187	187	157	152	183	144
1918	165	183	161	170	191	191	209	200	204	217	217	200	192
1919	191	174	170	165	161	157	161	152	165	170	174	152	166
1920	148	148	148	148	143	109	91	83	78	57	43	43	103
1921	43	43	48	65	43	52	43	43	48	61	48	48	49
1922	57	52	48	52	70	69	65	65	61	78	70	78	64
1923	100	78	78	83	87	91	96	104	109	122	135	148	103
1924	130	130	130	130	122	122	113	143	148	143	152	157	135
1925	161	165	170	174	174	174	161	152	152	152	152	157	162
1926	165	157	143	130	109	109	117	122	130	130	148	122	132
1927	130	135	130	113	113	113	122	122	130	135	130	126	125
1928	126	135	135	130	139	148	161	161	152	152	148	148	145
1929	148	135	148	148	143	135	126	135	143	139	130	139	139
1930	143	143	122	126	104	87	87	100	91	96	96	87	107
1931	83	78	74	74	65	61	52	52	48	52	57	48	62
1932	43	39	52	39	30	26	26	30	43	43	39	39	37
1933	39	35	35	35	48	78	87	83	83	83	87	87	65
1934	91	96	96	91	91	87	91	87	91	83	91	96	91
1935	87	87	83	74	74	83	96	91	91	91	100	100	88
1936	96	91	91	91	96	104	100	100	104	109	113	113	101
1937	122	122	122	126	135	135	135	152	143	126	126	122	130
1938	117	113	100	91	96	83	83	83	83	87	91	91	93
1939	91	91	91	87	87	96	96	91	104	104	100	100	95
1940	109	104	104	91	109	109	117	117	113	122	126	126	112
1941	122	126	126	139	148	157	157	139	143	148	148	148	142
1942	148	148	148	148	165	165	174	174	174	174	174	174	164
1943	174	174	174	174	183	196	183	183	178	178	178	178	179
1944	187	183	183	183	187	191	200	209	217	209	200	191	195
1945	178	178	183	182	182	182	183	191	200	208	213	200	190
1946	200	208	208	208	208	204	208	208	208	204	204	204	206
1947	195	187	187	187	187	169	173	......	......	......	......	......	......
Average	113	112	110	110	112	114	115	116	117	117	116	115	11[illegible]

Table 30. Oil Bearing Crops: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	72	69	79	86	91	......
1910	90	90	93	96	98	100	98	89	89	91	85	86	92
1911	90	84	84	84	78	70	73	83	62	59	65	64	75
1912	59	63	63	62	67	59	63	67	62	63	69	68	64
1913	70	75	74	75	78	68	64	69	68	66	62	64	69
1914	61	62	63	69	76	62	69	72	46	56	47	61	62
1915	66	71	71	70	73	68	66	59	73	106	118	119	80
1916	121	138	120	140	112	121	126	126	126	155	196	196	140
1917	172	156	182	190	201	200	187	207	184	215	228	226	193
1918	228	232	237	238	245	236	224	196	231	231	220	210	227
1919	210	210	214	217	217	215	214	217	207	217	240	236	218
1920	228	224	245	258	244	230	224	191	120	96	96	74	186
1921	71	67	66	65	60	62	60	74	92	97	100	85	75
1922	88	89	88	112	116	115	103	86	93	96	120	147	104
1923	131	121	121	133	134	124	131	138	138	138	145	141	121
1924	128	135	155	148	143	138	138	121	107	103	105	110	128
1925	121	116	117	116	123	110	138	111	115	102	85	79	111
1926	86	96	97	95	94	101	113	97	87	63	61	60	88
1927	63	77	79	84	83	83	86	87	116	119	118	124	93
1928	126	121	121	124	135	135	134	128	104	110	121	121	123
1929	121	121	128	124	121	117	114	100	100	107	104	107	114
1930	107	104	107	107	107	100	93	79	79	66	66	66	90
1931	69	69	73	73	73	66	67	46	28	23	30	31	54
1932	33	32	34	33	32	29	29	29	37	35	32	31	32
1933	31	31	32	35	41	41	48	48	41	44	45	45	40
1934	54	55	61	62	66	64	66	86	114	117	124	124	83
1935	131	131	131	124	127	124	124	100	100	114	117	117	120
1936	117	117	117	121	117	114	114	114	117	117	117	121	117
1937	124	128	128	132	132	121	118	84	63	60	63	63	101
1938	59	66	69	69	100	73	73	73	69	76	76	79	74
1939	79	79	77	79	78	80	71	47	70	77	76	79	74
1940	83	85	87	88	88	84	83	76	68	71	76	79	81
1941	84	83	86	91	97	100	117	122	161	177	167	165	121
1942	164	165	168	169	169	159	159	155	151	154	151	151	160
1943	154	154	158	160	162	163	160	175	178	178	175	168	165
1944	172	173	177	177	177	180	183	176	176	169	172	172	175
1945	176	176	176	180	180	184	183	176	169	172	176	179	177
1946	179	176	176	180	179	183	197	200	199	216	311	318	210
1947	311	304	311	308	288	254	254	......	......	......	......	......	......
Average	112	113	116	118	120	116	116	111	109	112	118	118	......

Table 31. Cottonseed: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	72	69	79	86	91	......
1910	90	90	93	97	98	100	98	89	89	91	86	86	92
1911	90	84	84	84	78	70	73	83	62	59	65	64	75
1912	59	63	63	62	67	59	63	67	62	63	69	68	64
1913	70	75	74	75	78	68	64	69	68	66	62	64	69
1914	61	62	63	69	76	62	69	72	46	56	47	61	62
1915	66	71	71	70	73	68	66	59	73	106	118	119	80
1916	121	138	120	140	112	121	126	126	126	155	197	197	140
1917	172	156	182	191	201	200	187	207	184	216	229	227	196
1918	228	232	237	238	245	236	224	197	231	231	221	210	228
1919	210	210	214	217	217	215	214	217	207	217	240	237	218
1920	228	224	245	259	244	230	224	191	120	96	96	74	186
1921	70	67	66	64	59	62	60	74	92	97	100	85	75
1922	88	89	88	113	116	115	103	86	93	96	120	147	104
1923	131	121	121	133	134	124	131	138	138	138	145	141	133
1924	138	134	155	148	143	138	138	121	107	103	105	110	128
1925	121	116	117	116	122	110	138	111	114	102	84	79	111
1926	86	96	97	95	93	101	113	97	86	63	61	60	87
1927	62	77	79	84	83	83	86	87	116	119	118	124	93
1928	126	121	121	124	134	134	134	128	103	110	121	121	123
1929	121	121	128	124	121	117	114	100	100	107	103	107	114
1930	107	103	107	107	107	100	93	79	79	66	66	66	90
1931	69	69	72	72	72	66	67	47	28	22	30	31	54
1932	32	32	34	33	32	29	29	29	37	35	32	31	32
1933	31	31	32	34	40	41	48	48	40	44	44	45	40
1934	53	55	61	62	66	64	66	86	114	117	124	124	83
1935	131	131	131	124	128	124	124	100	100	114	117	117	120
1936	117	117	117	121	117	114	114	114	117	117	117	121	117
1937	124	128	128	131	131	121	117	83	62	59	62	62	101
1938	59	66	69	69	100	72	72	72	69	76	77	79	73
1939	79	79	77	79	78	79	71	46	70	77	77	80	74
1940	83	85	87	88	88	84	83	76	68	71	76	79	81
1941	84	83	86	90	96	100	118	123	162	179	169	166	121
1942	165	166	168	170	169	159	159	155	152	155	152	152	160
1943	155	155	159	160	162	163	160	176	179	179	176	169	166
1944	172	172	176	176	176	179	183	176	176	169	172	172	175
1945	176	176	176	179	179	183	183	176	169	172	176	179	177
1946	179	176	176	179	179	183	197	200	200	217	314	321	210
1947	314	307	314	310	290	255	255	......	......	......	......	......	......
Average	112	113	116	118	119	116	116	111	109	112	118	118	115

Table 32. Peanuts: Relative Prices Received by Louisiana Farmers, August 1909—July 1947 (Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	72	72	72	70	68	......
1910	58	60	74	70	64	68	80	62	64	70	64	60	66
1911	100	90	80	90	90	84	100	94	94	96	74	80	89
1912	64	78	78	100	80	100	100	82	50	80	70	60	78
1913	74	64	58	80	86	100	100	80	80	94	76	78	81
1914	80	80	70	80	70	100	140	100	80	74	80	78	86
1915	140	80	50	120	112	106	100	130	140	120	100	84	107
1916	90	100	88	80	80	90	100	110	90	90	88	100	92
1917	104	90	120	108	140	120	106	100	100	110	120	130	112
1918	140	146	140	120	128	170	120	120	120	120	130	140	133
1919	120	158	172	172	174	168	160	140	180	200	180	200	169
1920	180	180	220	200	200	240	206	200	120	180	110	110	179
1921	160	120	128	120	140	100	120	140	160	140	120	120	131
1922	150	108	140	122	126	206	144	170	108	108	138	138	133
1923	108	130	120	120	120	140	140	140	140	160	150	140	134
1924	130	130	136	130	124	120	120	100	120	120	120	132	124
1925	130	130	140	130	164	144	162	152	140	120	118	126	138
1926	128	128	130	112	130	140	150	138	160	150	120	128	134
1927	130	146	130	114	136	150	166	140	148	148	150	136	141
1928	132	152	156	162	172	154	154	154	132	136	146	140	149
1929	152	142	138	142	148	158	154	152	140	132	132	136	144
1930	140	128	128	128	140	130	134	130	136	130	138	130	133
1931	124	106	120	120	130	122	110	110	90	80	76	78	106
1932	72	74	76	80	84	76	86	80	78	78	74	76	78
1933	70	72	74	82	84	84	92	78	84	94	86	82	82
1934	88	96	88	90	94	88	90	80	84	80	80	92	88
1935	94	94	102	108	96	92	100	96	96	94	92	96	97
1936	92	110	98	94	96	84	120	86	90	102	104	112	99
1937	112	106	98	114	112	110	108	108	102	96	96	96	105
1938	96	98	108	108	112	114	112	108	98	96	92	98	103
1939	100	104	104	104	106	108	108	108	114	106	110	104	106
1940	94	98	98	104	112	108	112	112	100	96	100	98	103
1941	98	102	98	100	100	100	100	106	106	106	114	116	104
1942	116	118	134	144	142	132	132	138	100	100	100	106	122
1943	110	116	120	130	140	140	140	140	140	150	142	150	135
1944	150	164	164	170	170	170	170	180	166	164	170	170	167
1945	170	168	174	174	180	180	180	180	180	180	180	180	177
1946	180	190	194	196	202	204	204	204	204	204	224	216	202
1947	216	216	228	250	240	240	240	......	......	......	......	......	......
Average	116	115	117	119	124	127	128	123	117	119	115	117	120

Table 33. Soybeans: Relative Prices Received by Louisiana Farmers, February 1937—July 1947 (Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1937	......	128	128	159	162	156	144	119	112	100	94	88	126
1938	81	81	84	84	91	94	94	88	88	78	72	72	84
1939	78	78	84	84	100	94	84	78	78	72	56	62	79
1940	66	78	78	84	94	97	88	72	69	66	59	75	77
1941	84	91	97	97	94	97	100	94	100	94	97	103	96
1942	119	128	144	156	156	156	156	144	125	122	109	109	135
1943	116	125	138	144	150	147	128	131	131	122	122	128	132
1944	144	188	212	225	225	219	175	175	162	150	150	156	182
1945	181	181	203	219	219	219	203	203	188	166	159	159	192
1946	159	163	181	194	181	197	197	184	175	156	188	188	180
1947	197	194	219	225	225	225	216	......	......	......	......	......	......
Average	114	124	135	145	147	148	137	129	123	113	111	114	128

Table 34. Vegetables and Truck Crops: Index Numbers of Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	103	105	98	91	89	......
1910	93	97	100	97	87	79	83	96	101	94	86	82	91
1911	89	95	99	103	102	97	111	109	113	108	95	90	101
1912	99	102	114	130	123	111	109	107	109	94	89	86	106
1913	98	106	113	119	121	106	91	100	99	101	98	91	104
1914	100	100	110	110	109	106	110	111	102	103	93	88	104
1915	91	100	106	109	118	112	105	102	93	86	78	78	98
1916	84	96	113	113	103	98	107	108	113	120	124	125	109
1917	134	158	200	205	202	196	187	182	190	166	160	163	179
1918	179	202	226	215	176	142	156	186	186	200	195	182	187
1919	196	222	223	252	235	228	228	247	252	201	207	204	225
1920	236	263	268	293	282	335	272	278	256	203	175	173	253
1921	175	170	173	186	171	172	194	170	159	161	154	149	170
1922	146	144	176	160	146	146	161	151	140	146	132	119	147
1923	157	171	192	188	176	168	161	167	205	182	173	168	176
1924	178	191	171	173	193	190	168	194	212	198	204	202	190
1925	185	209	243	297	274	222	213	220	241	234	221	195	230
1926	216	221	229	232	242	189	161	203	185	173	146	159	196
1927	151	163	163	184	144	164	168	163	166	140	134	143	157
1928	141	140	149	154	141	126	127	125	128	127	129	129	135
1929	128	143	144	152	159	165	169	168	165	157	146	148	154
1930	143	145	147	177	161	159	153	157	161	149	132	132	151
1931	122	120	123	127	118	94	91	100	91	85	87	83	103
1932	91	88	93	97	93	77	77	80	78	82	73	75	84
1933	63	66	71	79	83	83	84	116	106	89	83	85	84
1934	95	95	99	87	85	83	81	91	94	85	87	90	89
1935	97	97	103	116	95	92	99	91	85	84	82	82	94
1936	90	87	92	104	107	119	120	143	117	123	117	116	111
1937	123	133	124	120	112	108	103	104	106	97	96	99	110
1938	88	93	95	83	89	90	86	94	83	79	77	85	87
1939	94	97	103	107	99	98	102	104	101	94	89	94	98
1940	97	108	111	113	102	107	108	112	108	104	101	101	106
1941	104	112	112	119	103	108	113	113	112	109	105	111	110
1942	126	134	134	140	128	118	129	164	145	145	137	147	137
1943	197	203	235	259	242	245	400	271	259	252	241	238	254
1944	230	236	248	232	240	242	227	235	204	214	205	211	227
1945	228	242	252	246	259	257	279	286	205	210	220	233	243
1946	237	254	270	270	259	260	277	257	211	225	231	243	250
1947	243	243	236	236	224	250	228	......	......	......	......	......	......
Average	138	146	155	161	153	148	152	154	148	141	135	135	147

Table 35. Irish Potatoes: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	94	100	102	102	104	......
1910	112	122	120	106	91	78	73	82	88	92	99	94	96
1911	98	106	107	98	89	89	93	112	122	124	118	111	106
1912	116	118	122	139	139	117	100	98	99	89	88	96	110
1913	104	112	122	124	120	102	84	87	96	111	114	107	107
1914	109	120	124	116	111	103	96	106	111	116	116	116	112
1915	122	124	127	123	123	118	102	100	100	104	110	98	113
1916	97	124	156	152	127	113	104	111	139	174	190	193	140
1917	205	257	311	324	307	291	268	256	244	214	208	206	258
1918	211	240	249	220	149	96	107	136	159	170	176	183	175
1919	209	204	196	211	222	200	180	177	169	202	242	253	205
1920	289	251	364	400	344	383	294	311	269	242	230	222	308
1921	211	216	224	183	172	167	156	177	191	204	209	204	193
1922	216	256	279	206	173	146	156	156	158	187	194	167	191
1923	169	197	239	226	178	161	161	150	164	180	178	172	181
1924	204	167	139	156	150	161	128	133	183	178	178	156	161
1925	166	167	167	161	148	189	194	233	240	214	326	307	209
1926	264	311	311	311	283	159	147	189	167	167	178	200	224
1927	211	211	211	283	144	172	217	189	189	172	172	172	195
1928	167	167	178	178	130	78	100	94	94	122	128	128	130
1929	139	150	144	183	178	144	161	167	189	189	183	178	167
1930	172	178	178	250	153	144	144	150	183	161	144	144	167
1931	144	139	139	122	89	56	56	56	67	67	94	100	94
1932	99	89	106	133	117	61	61	61	72	89	67	78	86
1933	67	72	89	111	82	83	89	133	156	117	117	100	101
1934	128	128	144	100	81	42	67	83	83	83	100	111	96
1935	117	106	106	156	67	67	83	72	83	89	106	106	96
1936	100	89	106	139	128	161	133	144	144	144	156	150	133
1937	150	178	122	78	50	56	67	83	89	89	94	94	96
1938	94	106	100	67	67	61	67	78	89	83	89	106	84
1939	106	94	117	122	72	67	72	89	122	106	100	106	98
1940	111	122	122	128	90	87	89	94	89	94	106	94	102
1941	89	94	94	122	68	61	67	78	94	106	111	122	92
1942	139	156	156	178	133	89	106	139	133	144	144	150	139
1943	150	161	183	261	169	178	179	189	200	206	206	217	192
1944	217	217	228	150	139	122	122	161	183	200	189	189	176
1945	206	211	239	217	211	204	233	256	233	222	206	200	220
1946	222	222	239	217	144	122	189	211	211	222	222	211	203
1947	211	206	222	222	200	167	172	......	......	......	......	......	......
Average	155	164	172	174	142	128	128	139	146	147	154	152	150

Table 36. Sweet Potatoes: Relative Prices Received by Louisiana Farmers, August 1909—July 1947

(Aug. 1934—July 1939 = 100)

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
1909	......	......	......	......	......	......	......	108	108	96	84	78	......
1910	81	81	86	92	85	80	89	105	109	96	78	74	88
1911	84	88	95	107	111	103	122	107	107	97	81	77	98
1912	88	92	108	124	112	107	115	114	115	97	89	80	103
1913	95	101	107	116	122	108	95	108	101	95	88	81	101
1914	95	88	101	107	108	108	119	115	96	96	78	70	98
1915	74	84	93	100	115	108	107	103	88	74	58	65	89
1916	76	77	99	88	88	88	108	107	96	85	81	81	90
1917	88	95	128	128	135	135	135	135	155	135	128	135	128
1918	135	162	203	200	169	135	155	189	182	202	189	158	173
1919	176	216	223	270	230	230	243	284	297	176	162	149	221
1920	203	216	216	243	257	338	270	270	255	166	120	122	223
1921	134	122	122	177	151	157	208	147	115	111	93	88	135
1922	95	99	115	130	122	139	164	143	119	114	78	69	116
1923	112	126	143	143	147	141	126	146	219	159	141	135	145
1924	149	203	176	169	216	203	176	230	236	211	223	234	202
1925	203	257	332	459	416	270	247	238	281	281	181	134	275
1926	197	177	196	203	243	203	149	216	189	162	95	108	178
1927	122	149	149	149	149	176	155	162	169	122	108	128	145
1928	115	115	128	142	142	142	128	128	135	115	115	115	127
1929	115	142	149	142	162	196	196	189	169	149	128	135	156
1930	135	135	142	162	189	189	176	182	169	155	128	128	158
1931	122	122	128	149	149	115	108	123	101	88	74	61	112
1932	74	74	74	68	68	68	68	74	62	61	54	54	67
1933	54	55	58	62	88	88	88	122	95	81	68	81	78
1934	88	88	88	88	95	115	95	108	115	95	88	88	96
1935	88	95	108	108	115	108	114	101	81	74	68	68	94
1936	74	74	74	81	95	101	122	169	108	122	101	101	102
1937	108	115	128	149	149	135	115	108	108	88	81	88	114
1938	88	95	101	95	108	115	101	115	81	74	68	74	93
1939	74	88	88	95	108	108	115	108	81	74	68	74	90
1940	74	95	101	101	101	115	115	122	115	101	88	95	102
1941	95	108	108	115	115	122	128	122	108	95	81	88	107
1942	95	101	101	101	101	108	122	182	142	135	115	135	120
1943	149	155	216	223	243	243	608	297	264	243	216	203	255
1944	209	223	243	257	284	311	264	257	169	182	169	182	229
1945	209	230	236	236	270	270	304	304	128	149	182	216	228
1946	216	257	284	297	318	331	331	270	162	189	203	236	258
1947	236	257	230	230	216	297	243	......	......	......	......	......	......
Average	119	130	142	153	159	157	164	162	144	128	113	114	140

Table 37. Indexes of Season Average Prices Received by Louisiana Farmers for Crops not Marketed Throughout the Year, 1909-1946

Year	Sugar cane			Fruit and Nut Crops						Price Relatives for Truck and Vegetable Crops								
		Price relatives			Price relatives													
	Group Indexes	for Sugar	Syrup	Group Indexes	Oranges	Pears	Peaches	Straw-berries	Pecans	Cabbage	Spring beans	Fall beans	Carrots	Watermelons	Onions	Green Peppers	Tomatoes	For Processing
1909	124	126	105	72	......	......	72	......	......	......	......	......	......	......	......	......	......	......
1910	121	121	116	93	......	......	93	......	......	......	......	......	......	......	......	......	......	......
1911	138	141	116	93	......	......	93	......	......	......	......	......	......	......	......	......	......	......
1912	121	123	108	74	......	......	74	......	......	......	......	......	......	......	......	......	......	......
1913	104	103	113	139	......	......	139	......	......	......	......	......	......	......	......	......	......	......
1914	122	123	113	93	......	......	93	......	......	......	......	......	......	......	......	......	......	......
1915	147	150	126	88	......	......	88	......	......	......	......	......	......	......	......	......	......	......
1916	171	174	145	79	......	......	79	......	......	......	......	......	......	......	......	......	......	......
1917	225	234	155	116	......	......	116	......	......	......	......	......	......	......	......	......	......	......
1918	233	239	179	172	......	......	130	172	......	281	245	......	......	......	216	......	......	......
1919	441	461	282	204	211	189	167	187	302	268	255	......	......	......	385	......	......	......
1920	196	189	253	215	132	265	250	201	323	205	245	......	......	......	251	......	......	......
1921	122	119	142	198	181	347	134	195	219	115	299	......	......	......	128	......	......	......
1922	185	192	129	147	173	259	134	129	226	102	174	177	......	......	204	......	......	......
1923	225	233	155	176	64	258	176	180	195	218	277	187	159	......	242	......	......	......
1924	176	184	113	202	130	288	171	195	274	249	196	187	210	......	120	213	......	......
1925	129	133	92	183	169	220	162	180	206	115	147	187	143	......	184	197	319	......
1926	156	162	108	200	160	197	139	208	180	180	234	167	143	......	158	230	191	......
1927	148	152	116	179	266	212	167	165	211	111	147	131	104	......	165	197	106	......
1928	124	127	97	176	189	205	148	180	145	118	168	157	104	......	119	148	133	284
1929	122	124	108	148	217	205	157	132	190	113	147	111	127	......	146	152	133	213
1930	109	111	95	152	116	197	162	153	150	183	114	104	102	......	155	115	117	150
1931	108	108	103	118	101	136	97	123	98	85	88	96	63	......	135	107	133	149
1932	99	101	89	77	97	106	97	72	86	135	60	61	82	......	108	139	154	110
1933	106	108	87	81	109	152	102	78	73	110	35	69	76	......	119	98	96	87
1934	79	77	97	88	80	83	69	83	129	54	78	81	65	78	68	79	74	100
1935	105	105	105	101	123	114	97	101	91	117	77	101	122	83	112	80	80	77
1936	119	122	95	109	123	98	102	104	127	94	130	91	82	92	119	79	106	98
1937	97	96	108	93	104	106	116	92	85	117	125	136	122	88	88	98	133	100
1938	88	87	97	102	76	76	93	105	99	74	76	81	82	104	97	82	64	104
1939	94	92	108	100	83	106	97	101	100	105	98	96	92	131	95	180	122	124
1940	90	88	100	105	76	76	93	108	101	122	125	66	112	143	176	131	85	111
1941	131	129	147	89	91	91	97	85	104	112	136	167	112	155	146	98	122	125
1942	146	143	171	131	170	98	120	123	160	84	152	192	163	206	119	189	191	175
1943	156	151	195	222	258	258	287	217	208	344	250	242	214	399	223	533	372	303
1944	168	168	174	275	197	220	278	295	194	143	245	247	235	459	351	311	346	275
1945	183	184	179	283	193	197	273	302	221	133	272	278	265	477	284	361	356	260
1946	226	215	315	310	144	227	282	311	321	204	228	242	306	385	297	361	372	326

Table 38. Beef Cattle: Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	4.10	4.35	4.15	4.10	4.05	......
1910	3.90	3.40	3.60	3.60	4.50	4.40	4.40	4.40	4.30	4.10	3.50	4.00	4.00
1911	3.90	3.90	3.40	3.90	3.60	3.50	3.40	3.30	3.80	3.50	3.60	3.80	3.65
1912	3.80	3.70	3.60	4.00	4.40	3.80	4.30	4.20	4.30	4.00	4.00	3.80	4.00
1913	3.60	4.10	4.30	4.10	5.00	4.80	4.80	4.60	5.00	5.00	5.30	4.40	4.60
1914	4.70	4.70	5.10	5.10	5.30	5.50	5.50	6.00	5.30	6.00	5.00	5.10	5.30
1915	5.10	5.20	4.90	5.30	5.00	5.20	5.70	4.80	4.60	5.20	4.70	5.20	5.10
1916	5.40	5.40	5.30	5.90	5.80	5.40	5.40	5.40	5.60	5.50	5.20	5.50	5.50
1917	5.40	5.90	6.00	6.10	6.80	7.60	7.60	6.90	6.70	8.50	7.60	7.90	6.90
1918	7.40	6.90	7.10	7.10	7.40	8.00	8.50	8.60	7.80	8.00	7.50	6.70	7.60
1919	7.20	7.80	8.00	7.50	8.50	7.60	8.50	8.60	7.90	7.90	7.30	7.60	7.85
1920	7.50	8.00	8.00	8.70	7.50	7.70	9.70	8.80	7.50	7.50	6.80	6.40	7.85
1921	6.30	6.50	6.20	5.80	5.80	5.60	4.80	4.90	5.00	4.40	4.80	3.90	5.35
1922	4.50	4.60	4.20	4.40	4.50	4.70	4.60	4.40	4.30	3.90	4.10	3.80	4.35
1923	4.20	4.40	4.10	4.00	4.10	4.10	5.00	4.80	4.70	4.60	4.20	4.50	4.40
1924	4.70	4.80	4.60	4.30	4.90	4.60	4.70	4.30	4.50	4.70	5.00	4.60	4.65
1925	4.70	4.20	5.30	5.50	4.80	5.50	4.70	4.20	4.50	4.60	5.00	4.50	4.80
1926	4.60	4.40	4.50	4.60	4.50	5.10	4.40	4.10	4.70	5.00	5.00	4.80	4.65
1927	4.50	5.00	5.10	5.30	5.00	5.30	5.20	5.80	6.00	6.00	6.30	6.40	5.50
1928	6.40	6.20	6.80	6.50	7.60	7.50	6.90	7.50	8.10	8.60	7.20	7.40	7.20
1929	7.30	7.30	7.30	7.40	7.50	7.30	7.50	7.40	7.20	7.20	7.20	7.20	7.30
1930	7.00	6.90	6.80	6.70	6.20	6.00	5.50	4.70	4.70	4.70	4.60	4.50	5.70
1931	5.30	5.00	5.30	5.40	5.40	4.90	5.00	4.50	4.30	4.10	4.20	3.80	4.75
1932	3.90	4.20	4.10	3.50	3.50	3.50	3.70	3.60	3.65	3.50	3.40	3.25	3.65
1933	2.90	2.90	2.95	3.20	3.70	3.35	3.35	3.35	3.00	3.10	3.15	2.95	3.15
1934	3.00	3.20	3.20	3.20	3.25	3.65	3.35	3.25	3.85	3.40	3.55	3.55	3.35
1935	3.55	3.75	4.30	4.35	4.80	4.45	4.35	4.20	4.35	3.90	4.05	4.30	4.20
1936	4.80	4.50	4.20	4.80	4.50	4.70	4.40	4.50	4.70	4.30	4.30	4.60	4.50
1937	4.45	4.80	4.60	5.30	5.10	4.90	5.20	5.30	5.40	5.20	4.90	4.70	5.00
1938	4.65	4.55	4.75	5.00	4.80	4.70	4.80	4.80	4.40	4.40	4.40	4.65	4.65
1939	5.00	5.00	5.30	5.40	5.50	5.20	5.00	5.00	5.40	5.30	5.30	4.95	5.20
1940	5.30	5.20	5.40	5.70	5.90	5.70	5.80	5.10	5.70	5.70	5.45	5.20	5.50
1941	5.60	6.00	6.10	6.70	6.90	6.90	7.30	7.10	7.40	7.20	7.00	7.10	6.80
1942	7.40	7.90	8.30	8.90	8.70	8.70	8.30	8.30	8.50	8.50	8.50	8.60	8.40
1943	9.50	10.10	10.80	11.50	11.30	11.40	10.60	10.20	9.80	9.70	9.00	8.80	10.20
1944	9.10	9.70	10.20	10.00	9.70	9.40	8.80	8.70	8.40	8.50	8.50	8.60	9.15
1945	9.50	10.00	10.30	10.40	10.60	10.60	10.70	10.80	10.90	10.00	9.50	10.50	10.30
1946	10.40	10.80	11.10	11.30	11.40	11.90	13.20	12.80	11.70	12.50	13.30	13.00	11.95
1947	13.00	13.20	14.40	15.20	15.10	15.40	15.40	15.00	15.30	14.50	14.50	15.50	14.70

Table 39. Veal Calves: Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	4.95	5.10	5.30	4.80	4.75	......
1910	4.60	4.00	4.00	5.00	4.80	5.50	4.90	5.40	4.70	5.00	4.60	5.10	4.80
1911	4.80	4.70	4.20	4.20	4.20	4.20	4.90	4.50	5.70	4.70	4.50	5.10	4.65
1912	5.20	4.60	5.00	4.60	4.90	4.80	5.20	4.40	5.30	5.00	4.50	4.00	4.80
1913	3.80	4.40	4.80	4.00	6.00	5.60	5.50	5.50	5.00	6.70	5.70	4.80	5.15
1914	5.50	5.60	5.90	6.30	5.80	6.00	6.30	9.20	6.00	6.20	6.20	5.10	6.20
1915	5.80	5.90	5.70	6.20	6.10	6.00	6.60	5.90	6.10	6.00	5.30	6.00	5.95
1916	6.30	6.60	5.80	7.20	6.60	6.00	6.40	6.20	7.00	6.40	7.50	7.40	6.60
1917	7.00	6.90	8.70	8.90	9.50	8.10	9.10	8.00	8.70	8.70	9.40	9.20	8.50
1918	9.00	8.00	8.20	7.90	9.50	9.90	10.30	9.00	8.40	9.60	7.70	7.70	8.75
1919	7.80	8.20	8.50	8.60	9.20	8.60	9.00	9.40	8.90	9.30	9.50	8.30	8.80
1920	8.60	10.10	9.10	10.25	10.20	8.30	9.00	8.50	8.10	8.40	6.40	7.40	8.75
1921	7.30	7.70	7.40	7.20	6.90	6.40	5.70	4.90	5.30	5.30	4.60	5.70	6.20
1922	4.80	4.80	5.20	6.00	5.90	6.70	5.70	4.90	5.30	5.10	4.90	3.80	5.25
1923	4.50	5.10	5.20	5.10	5.60	5.20	5.50	5.40	5.10	5.20	5.00	5.00	5.15
1924	5.20	5.80	5.60	5.70	6.00	5.90	5.80	4.80	5.90	5.60	5.50	5.20	5.60
1925	5.20	6.00	6.00	7.20	6.30	6.50	5.90	4.30	5.30	7.00	7.00	5.90	6.05
1926	5.50	7.00	6.00	6.50	5.90	7.00	6.00	6.70	6.60	7.30	6.30	5.60	6.35
1927	6.00	7.00	6.80	5.90	5.60	6.70	6.30	7.30	7.90	8.00	7.90	7.30	6.90
1928	8.20	8.00	9.20	9.00	9.40	9.60	9.60	9.50	10.40	10.40	9.00	9.00	9.30
1929	9.60	9.10	9.80	10.00	10.60	10.30	10.00	10.20	9.70	9.30	9.40	9.20	9.75
1930	10.00	9.90	9.60	9.30	8.90	9.10	9.30	7.90	7.80	7.90	7.10	6.50	8.60
1931	6.40	6.10	6.30	6.70	7.10	6.10	7.30	6.50	6.00	5.50	5.20	5.10	6.20
1932	4.95	5.00	5.00	4.20	4.20	4.05	4.45	4.15	4.05	4.05	4.05	3.95	4.35
1933	4.05	4.10	3.90	3.95	4.80	4.15	4.40	4.60	4.35	3.90	3.85	3.65	4.15
1934	3.95	4.10	4.10	3.60	3.65	3.65	3.95	4.15	4.45	4.25	4.55	4.85	4.10
1935	4.85	4.85	4.85	4.95	5.50	5.70	5.10	5.20	5.90	4.90	5.40	5.90	5.25
1936	5.40	5.30	5.60	5.60	5.60	5.80	5.50	5.40	5.50	5.00	4.80	5.20	5.40
1937	5.80	5.70	5.70	6.30	6.40	5.80	5.90	6.30	6.50	6.20	6.20	5.80	6.05
1938	5.60	5.80	5.70	6.30	6.20	6.00	6.00	5.80	5.80	5.30	5.80	5.60	5.80
1939	6.10	6.20	6.80	6.90	6.90	6.90	6.60	6.40	7.10	6.70	6.30	6.10	6.60
1940	6.30	6.60	6.50	6.90	7.30	7.10	7.20	6.70	6.90	6.80	6.60	6.70	6.80
1941	7.10	7.60	7.70	8.30	8.60	8.50	9.00	8.90	9.30	9.30	8.90	9.00	8.50
1942	9.50	10.00	10.20	11.00	11.10	10.80	10.70	10.70	10.40	10.60	10.60	10.80	10.55
1943	11.20	11.80	12.30	13.00	13.00	13.50	12.90	12.10	12.00	11.60	11.30	10.80	12.10
1944	11.30	11.50	11.70	12.20	11.90	11.40	11.30	10.90	10.90	10.60	11.00	11.00	11.30
1945	11.80	11.90	12.10	12.40	12.40	12.50	12.50	12.50	12.30	12.00	11.90	12.00	12.20
1946	12.50	12.90	13.30	13.30	13.50	14.00	15.50	14.60	14.60	16.60	15.90	15.90	14.40
1947	16.00	17.00	18.00	18.40	18.40	19.00	19.40	19.10	19.20	18.00	18.00	19.30	18.30

Table 40. Sheep: Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	4.25	4.50	4.10	4.50	4.40	......
1910	4.20	4.70	4.80	4.60	4.30	3.50	3.50	3.60	4.50	4.00	5.00	6.00	4.40
1911	5.00	3.30	3.00	3.50	3.50	3.50	3.50	4.90	5.20	4.80	4.20	4.30	4.05
1912	4.50	4.70	4.90	4.80	4.10	4.00	4.00	3.00	6.00	3.80	5.00	3.80	4.40
1913	3.50	4.80	3.00	3.60	3.90	4.50	4.00	4.60	4.70	3.80	4.50	4.90	4.15
1914	4.60	4.50	3.60	5.90	5.10	5.50	4.90	5.80	4.50	5.00	4.90	5.00	4.95
1915	5.00	6.00	4.60	6.30	3.30	5.80	5.60	5.70	5.00	5.00	4.50	5.00	5.15
1916	4.50	5.50	5.10	5.60	6.30	5.00	5.50	5.50	5.40	5.40	6.50	5.80	5.50
1917	5.80	6.00	6.00	5.50	7.30	6.80	7.40	7.20	6.80	7.50	8.70	7.70	6.90
1918	7.50	7.30	8.30	6.60	8.80	9.00	9.40	8.20	8.00	8.40	8.00	7.00	8.05
1919	8.40	7.00	8.00	8.60	8.80	8.60	7.70	8.10	7.50	8.00	8.80	8.20	8.15
1920	7.70	7.20	6.60	7.40	7.30	8.80	9.00	7.80	6.50	6.60	7.00	6.30	7.35
1921	6.00	6.00	5.60	5.60	5.20	5.80	4.50	4.40	4.80	3.70	4.70	4.20	5.05
1922	4.70	3.30	3.10	4.60	5.20	3.50	4.30	4.80	4.00	3.70	4.60	3.30	4.10
1923	4.00	5.00	6.00	6.40	7.00	6.50	6.00	5.50	5.00	4.30	5.00	5.30	5.50
1924	4.50	4.80	5.00	5.20	5.50	5.00	4.50	5.00	5.00	5.60	6.20	7.00	5.30
1925	7.60	8.00	7.00	6.00	5.50	6.00	7.00	6.50	5.90	6.00	6.00	7.00	6.50
1926	7.70	7.20	6.70	4.50	4.60	4.20	4.10	5.50	7.50	5.50	6.80	5.80	5.85
1927	4.60	5.00	5.20	6.00	5.60	6.00	5.00	6.00	5.90	5.50	5.60	5.80	5.50
1928	5.20	5.20	7.00	6.00	6.60	7.00	6.60	7.00	7.50	8.00	7.50	7.90	6.80
1929	7.30	7.10	7.40	7.00	6.80	6.70	6.60	6.50	6.40	6.50	6.80	6.80	6.80
1930	6.90	6.80	6.40	6.30	5.60	5.60	5.20	5.70	6.10	5.10	5.00	5.30	5.85
1931	5.40	4.90	5.20	5.30	5.50	4.70	4.10	3.70	2.60	2.40	3.00	3.00	4.15
1932	3.30	4.00	3.90	3.70	3.50	3.30	3.20	3.40	2.95	3.10	3.55	3.50	3.45
1933	2.90	2.85	2.70	2.95	2.60	2.80	2.90	3.20	3.30	2.85	3.20	3.00	2.95
1934	3.25	3.30	3.00	3.00	2.90	2.70	2.65	2.95	2.85	2.75	3.05	3.35	3.00
1935	3.90	3.90	3.90	3.10	3.15	3.15	3.15	3.00	3.20	3.70	3.70	3.80	3.45
1936	4.00	4.00	3.60	3.80	4.05	4.05	3.90	4.00	3.90	4.10	3.80	4.05	3.95
1937	4.05	4.30	4.20	4.10	4.20	3.90	4.00	4.00	4.50	4.30	3.60	4.00	4.10
1938	4.00	4.20	3.70	3.75	3.75	3.70	4.00	4.00	3.80	3.80	3.80	3.20	3.80
1939	3.50	3.50	3.75	3.75	3.75	3.75	3.75	3.65	3.80	3.90	4.00	4.00	3.75
1940	4.00	4.20	4.20	4.00	4.00	3.90	4.20	4.00	4.00	3.75	3.80	3.60	3.95
1941	4.00	4.10	4.20	4.20	4.00	4.00	4.30	4.30	4.35	4.40	4.40	4.40	4.20
1942	4.60	4.80	4.80	5.50	6.00	5.30	5.30	5.60	5.60	5.60	5.60	5.70	5.35
1943	5.80	6.00	6.00	6.70	6.20	6.50	6.50	6.20	6.00	6.00	6.00	6.50	6.20
1944	6.00	6.20	6.20	6.50	6.00	6.30	6.10	5.90	6.00	6.50	6.50	6.50	6.20
1945	6.70	7.00	7.30	7.30	6.80	6.60	6.50	5.70	5.50	5.80	5.80	5.80	6.40
1946	5.80	6.00	6.00	6.50	6.60	6.60	7.40	7.10	7.30	7.50	7.00	7.00	6.75
1947	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.30	7.30	7.70	7.10

Table 41. Lambs: Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	4.60	5.00	5.10	5.00	4.60	......
1910	4.40	5.00	5.10	4.90	4.70	4.30	4.00	4.30	5.40	5.50	6.00	7.00	5.05
1911	5.30	3.50	3.50	4.40	5.50	4.60	4.80	5.10	5.70	5.00	4.70	4.50	4.70
1912	5.10	5.30	5.40	5.10	5.50	4.90	4.70	4.00	6.50	4.00	5.30	4.00	5.00
1913	4.30	5.10	6.00	5.00	4.50	5.40	5.30	5.00	5.50	6.00	5.30	5.70	5.25
1914	5.90	5.30	4.60	7.20	6.00	6.30	6.60	7.00	8.00	7.00	5.40	5.50	6.25
1915	5.60	7.00	5.30	8.00	5.20	7.30	7.80	9.00	8.80	8.60	8.30	8.00	7.40
1916	6.00	6.60	5.70	7.00	7.30	6.30	6.50	7.10	8.00	6.30	8.00	7.80	6.90
1917	7.50	8.00	8.40	8.30	9.00	8.70	8.50	9.00	7.20	8.00	9.00	8.70	8.35
1918	8.70	8.50	10.80	9.00	10.50	10.80	11.00	10.00	9.80	10.00	9.00	9.30	9.80
1919	9.50	8.00	9.00	11.00	11.30	12.20	10.40	8.60	7.60	8.20	9.00	9.50	9.50
1920	9.30	9.10	9.00	9.50	10.50	10.70	10.00	8.30	7.00	9.00	8.00	7.10	8.95
1921	7.80	8.40	9.00	6.30	7.20	7.20	5.80	5.10	6.10	5.40	6.50	5.20	6.65
1922	6.00	5.20	4.70	7.60	7.80	6.80	6.30	5.80	5.10	5.00	5.50	4.00	5.80
1923	5.00	6.00	4.50	7.00	7.50	7.90	8.10	7.50	7.00	6.80	6.60	6.40	6.70
1924	6.00	6.00	6.40	6.70	6.80	6.80	7.00	5.50	5.80	6.50	7.50	8.00	6.60
1925	8.50	9.00	8.50	8.00	7.50	8.00	8.50	7.50	6.70	7.00	9.00	9.50	8.15
1926	7.75	6.50	7.00	7.40	5.40	6.35	7.30	7.60	8.50	7.60	8.50	8.00	7.30
1927	7.30	6.00	8.00	8.20	7.60	7.00	6.00	7.00	7.90	8.70	9.50	8.00	7.60
1928	7.30	6.90	7.60	8.40	11.20	10.60	9.30	9.50	10.00	9.60	10.00	9.60	9.15
1929	9.20	9.10	9.80	9.00	9.20	9.70	9.90	10.00	8.50	9.50	10.00	9.50	9.45
1930	9.10	9.30	8.10	8.30	7.60	7.30	6.00	6.90	6.70	7.00	7.80	7.90	7.65
1931	7.40	6.70	6.00	7.00	7.30	7.10	6.70	6.00	5.20	4.70	5.20	5.20	6.20
1932	5.60	6.10	4.70	4.70	4.20	4.10	3.80	3.80	3.80	3.50	3.85	3.80	4.35
1933	3.45	3.75	3.95	4.10	4.30	4.35	4.40	4.40	3.70	3.85	4.20	4.20	4.05
1934	4.20	4.75	4.60	3.80	3.70	3.70	3.55	3.55	3.35	3.30	3.35	4.65	3.90
1935	5.50	5.20	5.00	5.00	4.50	4.70	4.30	4.30	4.30	6.00	6.00	6.00	5.05
1936	6.90	6.90	6.00	6.00	6.00	5.60	5.60	5.70	5.50	5.00	6.00	5.10	5.85
1937	4.90	5.20	5.20	5.30	6.00	5.60	5.20	5.80	5.80	5.80	5.40	5.40	5.45
1938	5.30	5.30	5.30	5.30	5.90	5.90	5.50	5.20	5.00	5.20	5.20	5.00	5.35
1939	5.00	5.00	5.40	5.70	5.70	5.70	5.70	5.50	5.60	5.50	5.50	5.50	5.50
1940	5.60	5.60	5.70	5.70	5.70	5.60	5.50	5.60	5.30	5.20	5.40	5.20	5.50
1941	5.40	5.30	5.60	5.70	6.00	6.00	5.90	6.00	6.20	6.20	6.40	6.70	5.95
1942	6.90	6.30	6.00	7.00	7.40	7.50	7.30	7.30	7.00	7.20	7.20	7.30	7.05
1943	7.30	8.00	8.10	8.20	7.80	8.60	9.60	8.90	8.50	9.00	9.00	8.60	8.45
1944	8.70	8.90	8.70	8.70	8.00	8.40	8.40	8.90	8.60	8.00	8.00	8.00	8.45
1945	8.90	9.40	10.00	9.80	9.80	9.80	9.70	9.60	9.40	9.20	9.40	9.40	9.55
1946	9.40	9.80	9.80	10.00	10.10	10.20	11.40	11.20	11.20	12.70	12.70	12.70	10.95
1947	12.30	12.40	12.90	11.80	12.10	14.20	14.20	14.00	14.50	13.50	13.90	13.50	13.25

Table 42. **Hogs:** Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	6.10	6.10	6.40	6.10	6.10	......
1910	6.10	6.00	7.40	8.00	7.10	6.80	6.80	6.70	6.30	7.20	6.70	6.30	6.80
1911	6.20	5.90	6.00	5.70	5.40	5.30	5.20	5.40	5.80	5.90	5.30	5.70	5.65
1912	5.40	5.30	5.10	5.30	5.90	5.10	5.70	5.80	6.00	5.90	6.00	5.80	5.60
1913	5.90	5.60	5.80	5.40	5.90	6.00	6.00	6.50	6.10	6.50	6.40	6.40	6.05
1914	6.20	6.50	6.30	6.50	6.50	6.50	6.90	6.80	7.40	6.80	6.40	6.30	6.60
1915	6.10	6.00	6.10	5.80	5.90	5.90	6.50	5.90	6.00	5.90	5.80	5.50	5.95
1916	6.00	5.90	5.80	6.30	6.30	6.70	6.20	6.80	7.40	7.60	7.90	7.60	6.70
1917	7.40	7.60	8.40	9.70	10.20	9.80	10.80	10.90	12.80	14.20	13.40	13.70	10.75
1918	12.00	12.60	13.40	13.10	13.60	13.10	12.40	13.30	14.00	13.10	14.50	14.50	13.30
1919	13.50	13.00	12.50	13.30	13.90	13.40	15.00	15.20	13.40	14.00	12.80	13.40	13.65
1920	13.50	12.70	12.50	12.70	12.80	13.00	13.80	13.30	13.60	11.80	11.80	10.10	12.65
1921	9.70	9.10	9.30	6.80	7.50	7.30	7.70	7.20	7.90	7.50	8.10	6.80	7.90
1922	6.80	6.70	7.10	6.80	7.00	6.50	6.70	6.50	7.30	7.10	7.60	7.20	6.95
1923	7.20	7.30	6.80	6.80	6.50	7.00	7.20	7.30	8.00	7.60	6.30	6.80	7.05
1924	6.90	7.10	6.90	6.60	7.00	7.10	7.10	7.50	7.60	7.70	8.00	8.50	7.35
1925	8.20	8.50	8.90	8.70	8.90	9.20	9.00	8.80	8.00	9.00	9.30	9.70	8.85
1926	9.00	9.10	9.20	9.00	8.40	8.70	10.00	9.40	8.80	10.00	10.20	9.80	9.30
1927	9.70	9.90	9.10	9.00	8.40	8.20	8.10	9.10	9.10	9.30	9.30	8.60	9.00
1928	7.90	7.30	7.50	7.70	7.70	7.50	8.10	8.20	8.20	8.70	8.00	7.80	7.95
1929	8.00	7.50	7.80	7.80	7.70	8.10	7.90	8.50	7.90	8.40	8.10	7.90	7.95
1930	7.40	7.90	8.10	8.00	7.90	8.00	7.90	7.40	7.50	7.80	7.70	7.00	7.70
1931	6.80	6.70	6.40	6.50	6.50	6.00	6.50	6.80	5.80	5.40	5.20	5.00	6.15
1932	4.70	4.70	4.70	4.30	4.30	3.60	4.00	4.40	4.40	4.10	3.90	3.85	4.25
1933	3.25	3.30	3.40	3.35	3.70	3.85	3.85	3.80	3.70	3.90	3.90	3.55	3.65
1934	3.55	3.65	3.70	3.80	3.60	3.85	3.95	3.95	5.00	4.55	4.55	4.50	4.05
1935	5.00	5.00	5.50	5.30	5.20	5.70	5.70	5.80	6.80	6.10	6.70	6.60	5.80
1936	6.40	6.10	6.20	6.00	6.30	6.30	6.10	6.80	6.60	6.70	6.80	6.80	6.40
1937	6.70	6.40	6.40	6.20	6.40	6.90	7.00	7.40	7.10	7.10	7.10	6.50	6.75
1938	5.80	5.80	5.90	5.90	5.80	6.10	6.20	6.20	6.20	6.00	6.20	5.70	6.00
1939	5.50	5.40	5.60	5.30	5.30	5.30	5.30	5.00	5.50	5.50	5.20	4.70	5.30
1940	4.45	4.25	4.25	4.30	4.65	4.35	4.55	4.55	4.95	4.90	4.90	4.90	4.60
1941	5.40	5.50	5.40	6.10	6.60	6.90	7.80	7.90	8.40	8.30	8.10	8.10	7.05
1942	8.40	8.90	9.80	10.50	10.60	10.60	11.30	11.50	11.30	11.70	11.70	11.70	10.65
1943	12.00	12.40	13.10	13.00	12.90	12.70	12.40	12.40	12.50	12.20	12.00	11.00	12.40
1944	10.60	10.40	10.00	10.40	10.20	9.80	9.40	9.90	10.00	10.60	10.90	11.00	10.25
1945	11.70	11.70	11.70	11.90	12.50	12.30	12.50	12.60	12.60	12.80	13.00	13.20	12.40
1946	13.20	13.20	13.00	13.20	13.30	13.50	16.20	17.50	15.70	22.70	20.40	19.40	15.95
1947	17.60	19.10	21.60	20.30	18.90	19.30	19.30	21.10	21.70	22.60	22.10	22.70	20.50

Table 43. Chickens: Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	12.0	12.0	12.0	12.4	12.2	......
1910	11.9	12.2	12.6	12.8	13.4	13.6	13.0	13.2	13.4	13.4	13.4	13.1	13.0
1911	12.8	13.0	12.9	13.1	13.6	13.4	12.7	13.2	13.9	14.0	13.9	13.8	13.4
1912	13.8	13.4	12.4	12.2	12.5	12.2	13.1	13.8	13.9	13.6	12.6	12.6	13.0
1913	13.0	12.7	12.6	12.8	12.8	13.2	14.5	13.7	13.6	13.1	13.6	13.7	13.3
1914	14.0	13.7	14.1	13.8	13.9	14.8	15.0	14.1	12.8	14.4	13.1	13.9	14.0
1915	11.9	12.5	13.8	13.7	12.9	13.1	13.3	12.6	12.7	12.4	14.5	13.5	13.1
1916	14.2	13.8	11.7	12.8	12.5	13.1	12.8	13.0	14.1	15.2	14.1	16.3	13.6
1917	14.6	14.0	14.6	16.0	16.0	18.2	16.9	15.9	18.7	16.5	17.4	18.0	16.4
1918	16.4	17.5	17.2	16.8	19.0	18.5	22.3	22.0	21.8	21.7	23.0	22.2	19.9
1919	23.4	22.2	20.0	18.5	22.5	23.5	24.0	27.0	30.0	26.0	25.0	26.0	24.0
1920	26.0	25.3	23.3	26.5	26.4	27.7	29.2	28.6	25.7	24.0	23.5	25.0	25.9
1921	25.0	24.0	24.7	22.9	21.0	25.0	23.0	19.0	22.0	21.0	21.1	19.8	22.4
1922	21.1	18.2	18.5	18.4	14.5	22.6	19.5	20.3	22.1	21.0	21.2	23.3	20.1
1923	20.0	19.0	20.4	19.0	18.0	23.0	25.0	21.0	24.9	25.0	22.4	22.7	21.7
1924	21.0	23.0	21.0	20.7	22.0	22.4	21.5	22.0	24.0	24.0	22.4	22.3	22.2
1925	22.0	21.4	21.3	21.2	24.8	25.6	22.5	21.5	22.6	21.8	22.9	22.8	22.5
1926	20.4	20.2	21.6	22.2	23.8	24.7	24.0	25.0	25.0	25.0	24.1	22.0	23.2
1927	23.2	22.6	22.0	23.9	24.3	23.8	22.6	23.0	23.0	22.8	23.9	22.0	23.1
1928	22.0	21.4	22.3	22.7	22.8	23.4	24.0	23.2	24.1	23.5	23.6	23.4	23.0
1929	23.0	22.6	22.3	22.8	24.4	24.8	24.1	23.2	23.3	22.8	23.1	22.7	23.3
1930	21.9	22.4	21.6	21.8	21.9	22.2	19.4	19.5	19.1	19.0	17.7	16.8	20.3
1931	16.7	16.2	16.9	17.9	17.7	18.4	16.8	16.0	15.5	15.1	15.8	14.9	16.5
1932	14.1	13.9	12.6	12.9	13.8	12.6	11.9	10.9	11.9	12.3	11.4	11.1	12.4
1933	10.6	10.3	9.8	10.5	11.5	11.5	11.2	11.0	11.0	10.4	10.6	10.2	10.7
1934	11.1	11.4	11.0	11.9	12.6	12.9	12.6	11.8	13.0	12.7	13.0	13.0	12.2
1935	13.2	13.3	13.6	15.0	15.2	15.8	14.9	14.4	15.8	15.5	16.8	17.0	15.0
1936	16.2	15.7	16.6	16.5	16.8	16.6	16.4	16.2	16.2	15.8	15.7	15.8	16.2
1937	15.3	14.5	15.0	15.5	15.8	15.8	15.3	15.5	16.4	16.6	15.7	16.0	15.6
1938	15.5	15.6	15.6	16.2	16.6	16.3	15.2	14.6	15.3	15.2	15.2	15.4	15.6
1939	14.7	14.5	15.1	15.9	15.8	15.7	15.4	15.3	15.6	15.6	15.0	14.5	15.3
1940	14.2	15.0	14.3	14.8	16.6	16.4	15.6	14.6	15.1	15.6	15.5	15.9	15.3
1941	15.0	15.2	15.6	16.5	17.6	17.7	18.0	17.5	18.3	18.3	19.2	19.4	17.4
1942	19.2	19.7	19.8	21.1	22.1	22.0	22.0	21.4	22.2	23.1	23.6	23.9	21.7
1943	24.1	2.55	27.1	30.1	30.5	30.0	30.0	28.9	28.9	29.2	28.8	28.7	28.5
1944	28.9	27.7	27.7	27.7	28.0	28.0	28.2	28.7	28.8	28.2	29.2	29.4	28.4
1945	29.2	29.0	29.7	29.7	31.1	31.7	33.2	34.2	34.2	32.0	33.0	35.1	31.8
1946	33.8	33.1	32.0	33.0	33.0	34.0	37.0	37.0	35.0	35.0	35.0	35.0	34.4
1947	35.0	35.0	34.0	35.7	37.3	38.3	38.0	37.0	39.6	36.7	34.6	36.6	36.5

Table 44. Turkeys: Average Price Per Pound Received by Louisiana Farmers, December 1922—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1922	......	......	......	......	......	......	......	......	......	......	......	27.0	27.0
1923	30.0	......	......	......	......	......	......	......	......	......	26.0	26.0	27.3
1924	27.0	......	......	......	......	......	......	......	......	23.0	25.0	29.0	26.0
1925	29.0	......	......	......	......	......	......	......	......	27.0	24.0	31.0	27.8
1926	29.0	......	......	......	......	......	......	......	......	......	31.8	32.0	30.9
1927	29.0	......	......	......	......	......	......	......	......	30.0	32.0	31.0	30.5
1928	29.0	......	......	......	......	......	......	......	......	24.0	29.0	31.0	28.2
1929	32.0	......	......	......	......	......	......	......	......	28.0	32.0	28.0	30.0
1930	30.0	......	......	......	......	......	......	......	......	21.0	22.0	21.0	23.5
1931	23.0	......	......	......	......	......	......	......	......	16.0	19.0	19.0	19.2
1932	19.0	......	......	......	......	......	......	......	......	16.0	15.0	15.0	16.2
1933	14.0	13.0	13.0	13.0	......	......	......	......	......	14.0	15.0	13.0	13.6
1934	14.0	14.0	13.0	......	......	......	......	......	......	15.0	17.0	17.0	15.0
1935	17.0	17.0	17.0	18.0	......	......	......	......	......	18.0	21.0	22.0	18.6
1936	21.0	19.0	20.0	20.0	......	......	......	17.0	19.0	19.0	19.0	19.0	19.2
1937	19.0	18.0	17.0	18.0	19.0	19.0	18.0	18.0	18.0	19.0	20.0	20.0	18.6
1938	20.0	19.0	19.0	19.0	18.0	18.0	17.0	18.0	18.0	18.0	18.0	19.0	18.4
1939	19.0	19.0	19.0	19.0	19.0	19.0	17.0	18.0	18.0	18.0	18.0	19.0	18.5
1940	17.0	17.0	17.0	......	18.0	17.7	17.0	17.0	18.0	18.0	18.0	18.0	17.5
1941	18.0	18.0	17.0	18.0	20.0	18.0	20.0	19.0	20.0	19.0	22.0	23.0	19.3
1942	21.0	20.0	21.0	23.4	22.8	23.0	22.0	23.0	22.2	24.7	26.6	31.5	23.4
1943	30.0	30.0	30.0	32.0	32.0	34.0	33.0	34.0	32.0	31.0	34.0	37.0	32.4
1944	37.0	35.0	34.0	33.0	33.0	33.0	31.0	32.0	32.0	33.0	38.0	39.0	34.2
1945	40.0	37.0	37.0	35.0	36.0	36.0	36.0	39.0	39.0	38.0	39.0	40.0	37.7
1946	40.0	37.0	37.0	35.0	37.0	37.0	38.0	36.0	37.0	39.0	45.0	41.0	38.2
1947	39.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	42.0	42.0	42.5	47.5	39.3

Table 45. Cowpeas: Average Price Per Bushel Received by Louisiana Farmers, February 1915—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1915	......	1.96	1.94	2.06	1.91	1.85	1.75	1.86	1.50	1.45	1.51	1.40	1.74
1916	1.62	1.28	1.55	1.64	1.54	1.38	1.20	1.40	1.43	1.35	1.70	1.85	1.50
1917	1.85	2.20	2.20	2.40	2.80	3.30	3.10	2.50	2.55	2.00	2.45	2.60	2.50
1918	2.70	2.90	3.10	2.95	2.80	2.60	2.75	2.95	2.15	2.50	2.50	2.75	2.72
1919	2.50	2.70	2.85	2.90	3.20	4.00	4.20	3.90	3.00	3.30	3.20	2.90	3.22
1920	3.70	3.60	3.70	4.40	5.20	4.30	3.70	4.60	3.60	3.43	2.61	2.62	3.87
1921	2.56	2.56	2.41	2.56	2.50	2.77	2.88	2.70	2.40	2.29	2.23	2.27	2.51
1922	2.14	2.20	2.41	2.52	2.45	2.06	2.13	2.11	2.07	2.26	2.28	2.40	2.25
1923	2.45	2.34	2.22	2.39	2.58	2.62	2.75	3.00	2.77	2.41	2.21	2.30	2.50
1924	2.40	2.50	2.75	3.00	3.10	3.20	3.00	3.00	3.30	3.10	2.50	3.00	2.90
1925	3.00	3.30	3.50	4.00	4.20	5.60	4.30	3.50	3.60	3.25	3.30	3.10	3.72
1926	2 80	2.88	3.66	3.95	3.70	3.90	3.40	3.90	2.80	3.00	3.10	2.75	3.32
1927	2.60	2.70	2.50	2.80	2.50	2.50	2.65	2.45	2.65	2.25	2.40	2.00	2.50
1928	2.30	2.40	2.35	2.45	2.55	2.55	2.65	2.45	2.35	2.25	2.15	2.50	2.41
1929	2 45	2.50	2.55	2.80	3.00	3.30	3.10	2.80	2.20	2.45	2.50	2.25	2.66
1930	2.55	2.70	2.90	3.00	3.10	3.20	3.30	2.90	2.75	2.45	2.60	2.25	2.81
1931	2.15	2.05	2 30	2.45	2.45	2.40	2.55	2.20	1.60	1.50	1.65	1.60	2.08
1932	1.60	1.35	1.45	1.32	1.10	1.15	.90	1.10	1.10	1.30	1.30	1.05	1.23
1933	1.00	1.00	1.05	1.05	1.15	1.25	1.35	1.50	1.30	1.20	1.15	1.10	1.18
1934	1.35	1.60	1.65	1.90	1.85	1.75	1.75	1.55	1.75	1.65	1.70	1.70	1.68
1935	1.70	1.85	2.00	2.15	2.05	2.10	1.85	1.70	1.45	1.45	1.45	1.35	1.76
1936	1.60	1.55	1.80	1.75	2.00	2.15	2.25	2.00	1.75	1.50	1.50	1.70	1.80
1937	1.90	1.95	2.00	2.10	2.25	2.25	2.05	1.95	1.70	1.50	1.50	1.60	1.90
1938	1.60	1.55	1.60	1.65	1.75	1.75	1.70	1.30	1.45	1.40	1.25	1.35	1.53
1939	1.30	1.45	1.50	1.55	1.60	1.65	1.50	1.50	1.40	1.25	1.00	1.25	1.41
1940	1.20	1.30	1.35	1.35	1.55	1.60	1.65	1.45	1.40	1.30	1.30	1.30	1.40
1941	1.35	1.45	1.50	1.50	1.50	1.55	1.55	1.55	1.45	1.50	1.50	1.60	1.50
1942	1.70	1.80	1.95	2.05	2.15	2.40	2.25	2.70	2.10	1.95	1.85	1.85	2.02
1943	2.05	2.30	2.45	2.50	2.75	2.85	2.60	2.70	2.60	2.60	2.60	2.55	2.55
1944	2.60	2.95	3.10	3.50	3.85	3.45	3.30	3.20	2.90	2.80	2.75	2.80	3.10
1945	2.85	3.05	3.20	3.50	3.60	3.40	3.50	3.40	3.00	2.90	3.00	3.00	3.20
1946	3.00	3.00	3.30	3.60	4.00	4.20	4.20	4.30	3.60	3.45	3.65	3.50	3.65
1947	3.75	3.50	4.10	4.60	4.60	4.80	4.40	3.65	3.45	3.45	3.25	3.25	3.90

Table 46. Eggs: Average Price Per Dozen Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	18.0	20.0	22.0	24.0	24.0	......
1910	25.0	22.0	19.0	18.0	18.0	18.0	17.0	18.0	19.0	22.0	24.0	26.0	20.5
1911	24.0	20.0	16.0	16.0	15.0	14.0	15.0	16.0	18.0	20.0	22.0	24.0	18.3
1912	25.0	22.0	18.0	15.0	15.0	14.0	16.0	16.0	18.0	21.0	24.0	25.0	19.2
1913	24.0	20.0	18.0	15.0	16.0	16.0	17.0	20.0	23.0	22.0	27.0	30.0	20.7
1914	26.0	22.0	17.0	16.0	17.0	17.0	16.0	17.0	23.0	22.0	21.0	28.0	20.2
1915	25.0	20.0	14.0	15.0	14.0	15.0	14.0	16.0	19.0	24.0	23.0	26.0	18.8
1916	26.0	18.0	16.0	16.0	15.0	16.0	16.0	18.0	21.0	25.0	28.0	34.0	20.8
1917	28.0	28.0	21.0	20.0	23.0	25.0	23.0	25.0	29.0	35.0	37.0	43.0	28.1
1918	41.0	39.0	25.0	27.0	27.0	25.0	27.0	30.0	32.0	37.0	43.0	45.0	33.2
1919	49.0	38.0	29.0	31.0	31.0	31.0	34.0	38.0	42.0	45.0	47.0	52.0	38.9
1920	56.0	47.0	36.0	35.0	35.0	35.0	34.0	41.0	41.0	49.0	51.0	61.0	43.4
1921	48.0	28.0	27.0	18.0	18.0	20.0	21.0	23.0	28.0	30.0	35.0	42.0	28.2
1922	31.0	29.0	16.0	19.0	18.0	20.0	21.0	23.0	29.0	31.0	37.0	40.0	26.2
1923	35.0	32.0	23.0	22.0	22.0	24.0	24.0	25.0	30.0	35.0	40.0	46.0	29.8
1924	39.0	37.0	22.0	21.0	22.0	22.0	23.0	24.0	30.0	38.0	37.0	47.0	30.2
1925	43.0	38.0	23.0	33.0	23.0	23.0	24.0	29.0	36.0	39.0	41.0	49.0	33.4
1926	40.0	32.0	23.0	22.0	24.0	24.0	25.0	26.0	33.0	36.0	38.0	45.0	30.7
1927	39.0	29.0	18.0	20.0	18.0	20.0	22.0	25.0	31.0	35.0	37.0	42.0	28.0
1928	40.0	26.0	24.0	22.0	22.0	23.0	25.0	27.0	32.0	36.0	39.0	40.0	29.7
1929	34.0	27.0	27.0	21.0	22.0	23.0	25.0	28.0	33.0	37.0	38.0	46.0	30.1
1930	41.0	34.0	21.0	22.0	21.0	21.0	21.0	22.0	26.0	28.0	29.0	32.0	26.5
1931	25.0	17.0	15.7	16.1	14.1	15.8	15.4	17.0	19.3	21.8	24.2	25.7	18.9
1932	20.8	12.1	9.3	10.0	9.1	9.8	9.6	12.0	17.0	19.6	22.8	26.7	14.9
1933	23.4	10.4	8.5	8.7	9.8	10.0	12.4	15.6	18.1	18.7	20.9	23.7	15.0
1934	19.3	16.8	11.8	11.8	11.9	13.5	14.7	15.8	22.1	23.1	24.3	28.7	17.8
1935	24.4	24.4	15.6	17.4	19.1	18.4	19.1	21.1	24.0	26.0	27.4	31.8	22.4
1936	24.0	21.3	16.2	15.8	16.2	18.4	19.3	21.6	24.8	26.4	29.5	37.4	22.6
1937	25.5	21.3	17.4	18.0	16.4	17.0	18.5	20.2	23.5	26.1	26.2	30.3	21.7
1938	22.0	15.2	13.7	14.5	15.2	15.3	16.5	18.7	22.2	24.3	25.9	29.3	19.4
1939	21.4	15.9	14.1	13.8	14.2	14.8	16.0	18.0	21.3	22.8	24.6	26.6	18.6
1940	20.7	24.7	13.3	13.3	13.9	13.9	15.0	17.8	20.3	22.2	24.2	27.4	18.9
1941	23.3	16.1	14.5	18.0	17.1	19.2	23.6	25.5	29.6	32.6	35.7	42.1	24.8
1942	32.7	25.0	21.9	23.6	23.7	25.5	26.2	26.9	32.8	37.3	39.7	43.3	29.9
1943	39.5	34.5	31.4	31.9	31.9	31.9	32.8	34.6	39.9	45.1	48.4	51.0	37.7
1944	47.5	33.1	30.0	24.1	26.4	27.6	27.8	29.7	35.0	41.5	46.8	49.7	34.9
1945	49.0	36.0	29.0	30.1	31.0	32.0	35.0	39.3	44.1	49.2	53.0	58.0	40.5
1946	53.0	39.0	29.0	29.0	32.0	34.0	41.0	45.0	51.0	54.0	58.0	57.6	43.6
1947	54.1	47.5	38.7	38.5	38.8	40.2	43.5	49.2	56.9	62.0	62.0	68.5	50.0

Table 47. **Cotton:** Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	11.4	11.6	12.7	13.6	14.2	......
1910	14.4	14.2	14.0	13.8	14.0	13.9	13.7	13.9	13.6	13.6	14.2	14.4	14.0
1911	14.3	14.1	13.9	13.8	14.1	14.4	13.8	12.9	11.0	9.8	9.0	8.6	12.5
1912	8.6	9.2	9.7	10.5	11.2	11.4	11.8	11.6	11.1	10.8	10.9	12.0	10.7
1913	12.2	11.6	11.6	11.8	11.8	11.8	11.8	11.8	12.4	13.2	12.4	11.8	12.0
1914	11.7	11.5	11.6	11.8	11.8	12.2	12.4	11.1	9.0	7.1	6.6	6.8	10.3
1915	7.0	7.4	7.7	8.4	8.6	8.2	8.1	8.2	9.4	10.9	11.2	11.2	8.9
1916	11.4	11.4	11.3	11.4	11.8	12.2	12.4	13.4	14.6	15.9	18.0	17.9	13.5
1917	16.8	16.3	16.6	18.1	19.4	22.4	24.2	23.7	23.4	24.4	26.2	27.6	21.6
1918	29.2	30.0	31.0	30.2	28.0	28.0	28.4	29.6	31.1	29.9	28.2	27.7	29.3
1919	26.8	25.1	24.2	24.4	27.5	30.6	31.7	31.1	30.8	33.7	35.4	37.0	29.9
1920	37.9	37.4	38.4	39.3	39.3	39.0	38.4	34.0	27.0	21.2	16.2	13.0	31.8
1921	12.2	11.8	10.2	9.4	9.6	9.4	9.2	10.0	14.5	17.8	16.2	15.2	12.1
1922	15.2	14.8	15.2	15.2	16.3	19.0	20.2	20.3	19.6	20.2	22.8	23.8	18.6
1923	24.6	26.4	28.0	27.8	25.7	24.8	24.0	23.2	25.2	27.3	29.0	32.0	26.5
1924	32.0	31.0	27.0	29.0	28.3	27.0	26.8	27.0	22.0	22.0	21.0	21.7	26.2
1925	21.8	22.3	23.1	22.5	22.1	23.0	23.0	22.5	21.7	20.8	18.1	17.4	21.5
1926	17.6	16.0	15.9	16.0	15.8	16.1	15.1	15.3	16.6	11.2	10.6	10.2	14.7
1927	10.3	12.0	12.4	12.9	14.2	14.9	15.3	16.9	22.7	20.3	19.4	18.3	15.8
1928	18.3	17.0	17.4	18.1	19.6	19.3	20.3	18.8	17.2	17.8	17.6	17.8	18.3
1929	17.8	17.7	18.7	18.1	17.7	17.4	17.3	17.1	17.9	17.1	16.2	16.1	17.4
1930	16.0	14.9	13.6	14.2	14.2	13.7	11.7	11.2	9.8	9.0	9.3	8.7	12.2
1931	8.6	8.9	9.2	9.2	8.6	7.5	8.5	6.0	5.7	5.0	6.0	5.5	7.4
1932	5.6	5.6	6.3	5.7	5.1	4.5	5.0	6.3	7.3	6.7	6.0	5.5	5.8
1933	5.7	5.6	6.2	6.2	8.1	8.6	10.3	8.7	8.9	9.0	9.4	9.4	8.0
1934	9.8	11.5	11.8	11.6	11.0	11.5	12.2	13.0	13.2	12.5	12.4	12.4	11.9
1935	12.2	12.0	11.5	11.6	12.1	11.6	11.7	11.3	10.5	11.0	11.4	11.1	11.5
1936	11.0	11.0	11.0	11.2	11.3	11.3	12.3	12.3	12.6	12.3	12.3	12.5	11.8
1937	12.4	12.4	13.3	13.8	12.8	12.0	12.2	10.7	8.9	8.0	7.5	7.6	11.0
1938	7.7	8.1	8.3	8.3	8.4	7.9	8.2	8.1	8.3	8.5	8.4	8.3	8.2
1939	8.3	8.2	8.3	7.9	8.4	8.4	8.6	8.6	9.1	8.6	8.8	9.6	8.6
1940	9.9	9.8	9.8	9.7	9.7	9.3	9.4	9.2	9.2	9.4	9.4	9.2	9.5
1941	9.5	9.4	9.9	10.5	11.4	12.4	14.0	14.9	17.4	16.7	16.1	16.6	13.2
1942	18.2	18.4	18.5	19.6	19.2	18.4	18.6	18.0	18.5	18.5	18.5	18.5	18.6
1943	19.3	19.3	19.5	19.9	19.9	19.9	19.9	20.1	20.2	19.7	18.9	18.4	19.6
1944	18.7	19.3	19.7	20.0	20.0	20.0	20.6	20.4	20.9	21.0	20.8	20.5	20.2
1945	20.7	20.6	20.5	20.8	21.2	21.5	21.5	21.6	21.8	22.6	22.6	22.6	21.5
1946	23.1	23.3	24.3	24.9	25.7	26.5	30.1	33.4	35.3	37.0	30.0	31.0	28.7
1947	31.0	31.6	33.0	33.3	33.6	34.7	36.3	34.7	32.1	31.2	31.8	34.2	33.0

Table 48. Rice: Average Price Per Bushel Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	.95	.81	.76	.74	.71	......
1910	.83	.74	.68	.79	.77	.69	.72	.76	.62	.62	.65	.67	.71
1911	.68	.63	.67	.59	.64	.61	.74	.76	.68	.72	.75	.72	.68
1912	.79	.90	.96	1.00	1.03	.96	1.16	.96	.92	.72	.87	.92	.93
1913	.96	.98	.95	.80	.83	.88	.93	1.01	.92	.86	1.08	.74	.91
1914	.84	.73	.60	.71	.85	.84	.92	1.17	1.05	.72	.74	.92	.84
1915	.86	.97	.99	1.01	.97	.97	.92	.87	.77	.72	.86	.76	.89
1916	.75	.91	.97	.99	.74	.91	.84	1.06	.83	.86	.94	.90	.89
1917	.90	.96	1.00	1.35	1.72	1.49	1.74	1.80	1.77	1.62	1.86	1.92	1.51
1918	1.96	2.07	2.26	2.09	2.32	2.14	1.93	1.95	1.89	1.69	1.65	1.69	1.97
1919	1.53	1.80	1.84	1.66	2.00	2.34	2.69	3.56	2.59	2.28	2.31	2.28	2.24
1920	2.87	2.78	2.87	2.62	2.42	2.70	2.11	1.72	1.58	1.28	1.28	1.00	2.10
1921	.81	.79	.82	.76	.84	.78	.75	.96	.98	.97	.88	.88	.85
1922	1.11	.97	1.08	.91	.87	.99	1.08	1.05	.81	.84	1.08	.97	.98
1923	.97	.93	1.09	1.10	.88	1.08	1.21	1.03	1.08	1.11	1.07	1.06	1.05
1924	1.10	1.11	1.08	1.12	1.30	1.35	1.37	1.32	1.29	1.28	1.31	1.41	1.25
1925	1.44	1.41	1.39	1.38	1.42	1.49	1.50	1.46	1.43	1.44	1.52	1.53	1.45
1926	1.54	1.50	1.43	1.31	1.37	1.41	1.46	1.16	1.18	1.12	1.11	1.10	1.31
1927	1.11	1.08	1.09	1.05	1.04	1.02	1.04	.90	.91	.94	.91	.92	1.00
1928	.93	.89	.90	.92	.96	.98	.93	.92	.92	.91	.94	.95	.93
1929	.98	.96	.96	.97	.93	.94	.94	1.00	.99	.98	.99	.98	.97
1930	1.00	1.07	1.03	1.07	1.06	1.04	.99	.88	.79	.77	.76	.73	.93
1931	.75	.78	.76	.77	.74	.74	.73	.56	.47	.47	.60	.59	.66
1932	.56	.53	.52	.49	.49	.48	.46	.47	.47	.42	.41	.41	.48
1933	.38	.36	.40	.47	.56	.60	.61	.65	.75	.78	.80	.75	.59
1934	.78	.79	.80	.81	.78	.77	.75	.79	.78	.83	.85	.78	.79
1935	.77	.82	.85	.86	.87	.90	.88	.74	.55	.65	.70	.74	.78
1936	.83	.85	.83	.84	.89	.89	.90	.91	.99	.87	.84	.82	.87
1937	.92	.97	.98	1.00	.95	.89	.85	.76	.65	.80	.83	.68	.86
1938	.72	.66	.63	.57	.58	.63	.64	.64	.60	.65	.69	.65	.64
1939	.66	.69	.65	.64	.64	.64	.63	.58	.89	.76	.78	.74	.69
1940	.75	.69	.65	.65	.75	.75	.79	.79	.64	.70	.80	.83	.73
1941	.96	1.06	1.05	1.25	1.25	1.21	1.17	1.06	.87	.96	1.28	1.49	1.13
1942	1.58	1.66	1.78	1.82	1.82	1.72	1.70	1.60	1.60	1.47	1.55	1.70	1.67
1943	1.80	1.80	1.82	1.87	1.84	1.84	1.80	1.62	1.61	1.74	1.92	1.90	1.80
1944	1.94	1.96	1.90	1.91	1.80	1.74	1.73	1.65	1.61	1.83	1.85	1.88	1.82
1945	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.65	1.66	1.78	1.90	1.85	1.82
1946	1.85	1.80	1.95	1.95	2.00	2.00	2.00	1.75	1.97	2.36	2.48	2.50	2.05
1947	2.35	2.70	2.70	2.60	2.60	2.46	2.80	2.82	2.32	2.43	2.65	2.71	2.59

Table 49. Corn: Average Price Per Bushel Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	82	73	69	70	71	......
1910	73	74	74	77	80	82	80	74	68	63	58	58	72
1911	59	60	62	66	66	66	69	70	68	68	70	70	66
1912	71	72	75	81	92	92	92	88	74	68	68	70	79
1913	72	72	77	79	80	82	82	84	82	82	80	77	79
1914	76	77	78	79	84	89	90	86	86	84	76	82	82
1915	86	86	90	94	95	100	98	90	84	71	64	66	85
1916	68	72	78	79	77	76	78	82	83	82	88	99	80
1917	101	102	112	130	148	161	178	184	170	154	148	150	145
1918	151	158	177	183	176	174	177	188	183	170	164	163	172
1919	165	167	162	168	180	180	184	184	174	167	157	158	170
1920	160	168	188	198	199	199	194	174	148	118	92	90	161
1921	96	100	92	88	96	98	96	88	76	66	64	68	86
1922	66	70	80	80	78	82	88	85	82	81	82	85	80
1923	88	93	104	110	110	113	112	106	103	104	105	105	104
1924	108	109	120	115	110	110	115	122	124	128	126	114	117
1925	116	125	130	120	140	132	124	110	110	100	102	98	117
1926	115	100	100	106	102	100	104	90	95	92	89	80	98
1927	85	89	84	88	91	95	109	105	100	90	89	94	93
1928	96	98	102	102	107	116	118	110	110	93	95	93	103
1929	91	91	99	108	101	103	106	102	96	92	92	92	98
1930	91	95	95	100	99	98	94	96	99	98	91	89	95
1931	89	87	89	87	83	84	82	69	56	41	42	44	71
1932	44	43	45	43	43	46	46	44	41	41	38	39	43
1933	36	37	39	45	55	54	66	65	57	56	57	58	52
1934	59	65	67	69	71	74	75	77	81	80	83	92	74
1935	91	96	98	102	100	97	95	88	76	70	67	66	87
1936	65	68	72	74	74	74	81	94	99	93	89	94	81
1937	96	96	100	109	108	103	105	93	79	67	60	60	90
1938	63	63	65	69	67	67	66	62	56	50	49	49	60
1939	51	51	54	58	59	64	64	59	60	60	60	61	58
1940	64	67	71	71	75	74	73	73	64	61	62	60	68
1941	63	66	68	74	74	74	75	75	77	75	76	76	73
1942	80	85	90	96	98	96	98	95	93	90	92	95	92
1943	96	103	109	114	119	120	124	121	123	129	129	136	119
1944	137	140	145	142	141	145	144	138	140	138	136	138	140
1945	141	142	142	145	142	137	137	140	135	130	130	134	138
1946	130	136	143	143	155	165	197	189	172	175	175	175	163
1947	175	179	184	184	187	190	195	211	224	215	216	219	198

Table 50. Oats: Average Price Per Bushel Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	64	62	63	63	62	......
1910	60	60	63	60	58	59	59	54	52	50	50	50	56
1911	52	55	56	54	60	60	60	62	61	63	65	60	59
1912	61	64	64	68	67	65	62	58	54	52	52	52	60
1913	54	54	54	54	54	55	56	56	56	56	56	56	55
1914	58	61	60	58	58	56	58	60	64	66	64	66	61
1915	68	68	70	74	74	72	70	62	54	56	56	56	65
1916	56	58	60	60	60	58	57	58	55	56	63	68	59
1917	71	72	74	77	80	82	86	96	91	89	96	92	84
1918	84	87	101	110	110	106	108	112	108	105	101	97	102
1919	96	94	92	98	100	104	106	102	93	89	97	96	97
1920	104	120	120	116	118	119	124	117	102	106	96	78	110
1921	88	91	76	71	62	55	59	62	70	74	70	68	70
1922	62	64	65	62	56	54	58	62	64	62	64	64	61
1923	65	66	66	73	72	70	66	63	64	67	69	63	67
1924	66	66	65	61	65	65	67	60	68	70	78	81	68
1925	84	85	85	70	68	75	76	61	64	70	75	80	74
1926	65	59	63	61	60	56	60	60	61	64	70	65	62
1927	60	65	65	60	60	63	60	62	65	62	68	65	63
1928	64	67	71	77	80	81	77	69	62	64	67	65	70
1929	63	68	67	64	65	70	68	69	70	71	68	67	68
1930	69	68	65	64	65	64	56	58	57	55	54	56	61
1931	54	52	56	47	51	45	39	33	36	31	33	34	43
1932	32	32	33	32	33	31	31	30	30	27	26	28	30
1933	28	28	30	32	34	37	48	47	46	42	45	42	38
1934	44	45	50	48	48	51	48	58	58	68	73	65	55
1935	65	64	63	65	64	59	56	54	50	46	46	44	56
1936	42	46	45	40	45	35	43	51	54	50	56	57	47
1937	60	60	64	64	66	54	58	51	49	49	47	45	56
1938	43	42	42	42	41	38	38	34	37	37	38	37	39
1939	40	40	41	40	38	39	36	35	46	45	45	45	41
1940	46	50	50	50	50	43	40	40	40	42	43	43	45
1941	43	43	43	45	44	40	41	41	45	52	54	56	46
1942	56	57	60	60	60	55	55	55	56	60	60	65	58
1943	66	71	76	78	80	76	81	85	92	101	100	102	84
1944	102	103	102	99	97	98	98	97	98	96	99	98	99
1945	97	98	97	98	97	80	84	84	85	86	87	92	90
1946	92	92	92	98	103	113	124	121	116	110	115	113	107
1947	107	112	115	115	115	109	108	106	115	129	135	130	116

Table 51. **Hay:** Average Price Per Ton Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May	June	July	Aug.	Sept.	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	11.05	10.85	10.30	10.35	10.35	......
1910	10.50	11.50	12.05	11.75	11.05	11.20	11.15	11.60	11.50	10.30	10.85	10.75	11.20
1911	10.90	11.80	11.80	11.45	10.85	11.15	12.05	12.20	11.25	10.90	11.65	12.20	11.50
1912	12.90	14.00	15.05	15.25	14.50	13.50	12.70	12.20	12.15	11.40	11.60	13.35	13.20
1913	13.35	12.70	12.50	12.15	11.75	11.50	11.55	12.10	12.00	12.15	12.70	12.25	12.20
1914	12.45	13.25	13.50	13.00	12.50	12.25	12.25	12.45	12.55	12.40	12.10	11.55	12.50
1915	10.90	11.30	11.95	12.75	13.30	13.45	13.40	12.65	11.70	11.60	11.20	11.25	12.10
1916	11.50	10.70	11.60	12.30	12.20	11.45	11.00	11.00	11.00	11.50	11.25	11.30	11.40
1917	12.00	12.65	12.55	13.30	15.70	16.00	15.15	14.40	13.60	15.00	15.30	14.90	14.20
1918	17.75	19.98	19.98	20.75	21.30	20.15	18.15	17.85	18.55	19.25	20.60	21.10	19.60
1919	21.50	22.40	23.90	25.50	25.45	23.45	22.50	22.50	19.85	19.35	22.00	22.50	22.60
1920	23.75	23.75	23.00	24.15	24.65	23.00	22.35	20.90	18.30	17.10	15.85	16.20	21.10
1921	17.25	17.90	17.40	15.95	14.85	14.75	14.45	13.95	13.75	13.00	13.05	13.30	15.00
1922	12.15	12.35	12.50	12.50	13.00	13.90	13.60	13.00	12.95	12.40	12.90	14.15	12.95
1923	14.15	14.00	14.85	14.90	15.45	15.55	15.25	14.25	13.25	14.00	14.75	15.00	14.60
1924	15.00	15.00	15.00	14.50	15.00	15.00	15.00	18.00	17.00	18.00	16.30	19.00	16.05
1925	20.00	20.50	22.00	18.00	17.40	17.70	18.00	14.00	15.00	15.60	13.90	18.00	17.50
1926	19.40	20.90	18.90	19.90	21.00	19.00	18.00	20.00	17.00	15.00	14.90	14.80	18.25
1927	13.50	14.40	13.00	14.00	14.00	13.00	13.50	13.00	11.00	13.00	12.50	13.50	13.20
1928	15.00	15.50	14.50	14.30	13.90	14.10	14.00	13.00	13.10	12.20	12.20	13.10	13.75
1929	12.80	13.30	14.30	13.50	13.50	12.50	13.00	12.00	12.50	12.40	12.40	13.20	12.95
1930	12.70	13.40	13.90	13.00	12.00	13.00	12.00	12.00	12.90	13.00	12.00	11.60	12.60
1931	11.60	12.50	12.50	11.50	10.90	11.00	9.50	9.20	8.40	8.60	7.80	8.00	10.10
1932	8.20	8.10	8.80	7.40	7.40	7.00	7.00	7.00	7.50	7.50	8.10	7.70	7.65
1933	6.70	7.10	7.20	6.80	7.50	7.50	6.90	8.30	8.00	7.60	7.20	7.50	7.35
1934	8.30	7.40	8.20	7.50	7.00	8.00	8.10	8.10	9.50	9.30	9.00	9.70	8.35
1935	10.00	11.00	12.00	10.60	10.10	9.30	9.20	8.80	8.50	8.00	9.50	8.80	9.65
1936	9.40	8.90	10.70	9.30	10.60	8.80	9.20	10.70	11.40	10.50	9.50	10.30	9.95
1937	11.10	11.00	10.50	10.30	10.60	10.50	10.10	9.30	9.80	9.70	10.20	9.70	10.25
1938	10.10	10.80	10.10	10.00	10.30	9.50	9.90	9.00	9.00	9.30	8.60	9.50	9.70
1939	9.00	9.00	10.00	10.00	9.00	8.30	8.90	8.00	8.70	8.10	8.90	8.90	8.90
1940	9.60	10.70	10.70	10.00	10.40	9.50	9.30	7.70	7.80	8.40	8.40	9.00	9.30
1941	8.60	8.90	9.30	9.50	10.00	10.00	9.00	8.20	9.00	9.20	9.00	9.30	9.15
1942	9.60	10.40	11.00	11.30	10.80	10.60	10.00	9.40	10.20	10.50	10.70	11.60	10.50
1943	12.20	13.70	14.20	14.40	12.80	12.50	14.00	14.50	14.20	14.50	16.00	16.20	14.10
1944	17.60	18.50	18.40	18.30	16.00	15.40	15.00	16.00	16.50	15.30	16.60	16.70	16.70
1945	17.50	17.50	17.00	16.00	16.00	16.50	16.00	16.00	14.50	15.00	15.50	16.00	16.10
1946	16.00	16.50	16.00	16.00	15.50	15.00	16.10	16.10	17.10	16.80	18.00	18.00	16.40
1947	18.00	17.30	17.80	18.00	16.20	15.10	16.10	15.70	18.70	19.20	19.80	20.30	17.70

Table 52. Milk (wholesale): Average Price Per Hundred Pounds Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	1.80	2.05	2.25	2.35	2.35	......
1910	2.45	2.45	2.45	2.40	2.10	2.05	2.05	2.15	2.25	2.35	2.45	2.50	2.30
1911	2.50	2.50	2.40	2.20	2.05	2.00	2.05	2.15	2.20	2.25	2.55	2.60	2.30
1912	2.60	2.45	2.35	2.30	2.20	2.05	2.05	2.10	2.15	2.35	2.40	2.40	2.30
1913	2.50	2.35	2.30	2.25	2.10	2.05	2.15	2.25	2.35	2.40	2.50	2.50	2.30
1914	2.55	2.40	2.35	2.25	2.10	2.05	2.15	2.25	2.35	2.40	2.50	2.60	2.35
1915	2.70	2.65	2.55	2.55	2.40	2.15	2.25	2.30	2.60	2.65	2.65	2.65	2.50
1916	2.40	2.40	2.40	2.35	2.35	2.30	2.25	2.40	2.50	2.65	2.85	2.85	2.50
1917	2.90	2.90	2.80	2.70	2.65	2.60	2.65	2.70	2.95	3.25	3.40	3.40	2.90
1918	3.65	3.65	3.50	3.30	3.30	3.30	3.30	3.35	3.70	4.35	4.35	4.35	3.70
1919	4.40	4.40	4.35	4.35	4.30	4.30	4.25	4.25	4.35	5.20	5.20	5.20	4.55
1920	5.20	5.20	5.15	5.15	4.20	4.20	4.15	4.15	5.05	5.10	5.10	4.35	4.75
1921	4.35	4.30	3.80	3.75	3.75	3.70	3.70	3.75	3.75	3.80	3.10	3.10	3.75
1922	3.15	3.10	3.10	3.05	3.05	3.00	3.00	3.00	3.05	3.10	3.10	3.10	3.05
1923	3.15	3.10	3.10	3.05	3.05	3.00	3.00	3.00	3.05	3.35	3.35	3.35	3.15
1924	3.45	3.35	3.35	3.30	2.85	2.80	2.75	2.75	2.80	2.85	2.90	2.90	3.00
1925	2.95	2.90	2.85	2.80	2.45	2.40	2.35	2.35	2.80	2.90	2.90	2.90	2.70
1926	2.95	2.85	2.85	2.75	2.75	2.70	2.65	2.70	2.80	2.85	2.90	2.90	2.80
1927	2.90	2.85	2.70	2.65	2.65	2.60	2.55	2.60	2.65	2.80	2.80	2.80	2.70
1928	2.85	2.80	2.70	2.65	2.65	2.60	2.55	2.60	2.85	2.85	2.90	2.90	2.75
1929	2.95	2.90	2.90	2.65	2.65	2.55	2.55	2.65	2.80	2.80	2.85	2.85	2.75
1930	2.85	2.70	2.65	2.45	2.45	2.40	2.40	2.40	2.50	2.60	2.65	2.65	2.55
1931	2.60	2.45	2.20	2.15	1.95	1.90	1.95	1.95	2.00	2.05	2.05	1.95	2.10
1932	1.85	1.75	1.45	1.35	1.35	1.25	1.25	1.30	1.35	1.45	1.50	1.50	1.45
1933	1.45	1.30	1.25	1.15	1.15	1.15	1.55	1.60	1.65	1.75	1.90	1.95	1.50
1934	1.65	1.65	1.60	1.45	1.40	1.40	1.50	1.75	1.90	2.00	2.05	2.05	1.70
1935	2.15	2.15	2.00	1.85	1.80	1.80	1.85	1.90	1.95	2.05	2.05	2.15	2.00
1936	2.15	2.05	2.05	1.95	1.85	1.95	1.95	2.15	2.25	2.30	2.35	2.35	2.10
1937	2.35	2.30	2.30	2.25	2.15	2.10	2.15	2.20	2.25	2.35	2.40	2.40	2.25
1938	2.45	2.40	2.30	2.15	2.10	2.05	2.00	2.05	2.05	2.10	2.20	2.40	2.20
1939	2.20	2.15	2.10	1.90	1.85	1.85	1.95	1.95	2.15	2.25	2.25	2.40	2.10
1940	2.40	2.35	2.30	2.20	2.15	2.15	2.15	2.20	2.30	2.40	2.45	2.45	2.30
1941	2.40	2.35	2.30	2.25	2.25	2.25	2.25	2.40	2.60	2.65	2.80	2.80	2.45
1942	2.85	2.95	2.90	2.80	2.65	2.65	2.75	2.90	3.15	3.30	3.45	3.55	3.00
1943	3.50	3.50	3.45	3.55	3.50	3.55	3.60	3.65	3.70	3.75	3.90	3.90	3.65
1944	3.85	3.85	3.80	3.75	3.70	3.65	3.65	3.70	3.80	3.85	3.90	3.90	3.80
1945	3.90	3.85	3.85	3.75	375	3.75	3.75	3.75	3.80	3.90	3.95	3.95	3.85
1946	3.85	3.85	3.90	3.85	3.75	4.20	5.05	5.45	6.00	6.10	6.30	6.30	4.90
1947	5.75	6.30	5.95	5.40	5.00	4.80	5.10	5.45	5.90	6.30	6.75	6.80	5.80

Table 53. Milk (retail): Average Price Per Quart Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	9.0	9.2	9.4	9.4	9.4	......
1910	9.4	9.2	9.0	8.8	8.6	8.6	8.8	9.0	9.2	9.4	9.4	9.4	9.1
1911	9.4	9.2	9.0	8.8	8.6	8.6	8.8	9.0	9.2	9.4	9.4	9.2	9.0
1912	9.4	9.2	9.0	8.8	8.6	8.6	8.8	9.0	9.2	9.4	9.4	9.4	9.1
1913	9.2	9.0	8.5	8.4	8.2	8.2	8.4	8.8	8.8	8.8	9.5	9.0	8.7
1914	9.0	9.0	8.8	8.6	8.4	8.4	8.4	8.8	9.0	9.2	9.4	9.4	8.9
1915	9.4	9.2	9.2	8.5	8.4	8.6	9.0	9.0	9.0	9.0	9.5	9.4	9.0
1916	9.2	9.2	8.8	8.6	8.4	8.2	8.5	8.8	9.0	9.0	9.2	9.8	8.9
1917	9.8	9.8	9.8	10.0	10.2	9.5	10.0	10.5	10.8	11.5	11.6	12.0	10.5
1918	12.0	12.0	11.8	11.8	11.5	11.5	11.8	11.8	12.0	12.8	13.2	13.6	12.2
1919	13.2	12.8	12.8	12.8	12.8	12.8	12.8	13.2	14.0	14.2	15.0	15.2	13.5
1920	16.2	15.2	15.0	15.0	15.0	15.0	15.5	15.6	15.8	17.0	16.8	16.2	15.7
1921	15.2	14.8	14.6	13.8	13.0	13.0	12.8	11.5	11.8	11.8	13.5	12.8	13.2
1922	12.6	12.5	12.2	11.8	11.2	11.2	11.8	12.0	12.2	12.2	12.5	12.6	12.1
1923	12.6	13.5	12.2	12.0	11.8	11.8	11.8	11.4	11.6	11.8	12.9	13.6	12.2
1924	13.7	13.8	14.0	12.0	11.3	11.4	11.6	11.6	12.3	13.0	13.3	12.7	12.6
1925	12.2	12.1	12.0	11.4	11.4	11.5	12.0	12.0	12.8	13.2	13.4	13.4	12.3
1926	13.4	13.6	13.2	12.6	12.6	12.0	13.0	13.1	13.2	13.2	13.2	13.4	13.0
1927	13.6	13.6	13.6	13.3	13.2	13.2	13.3	13.3	13.4	13.4	13.6	13.6	13.4
1928	13.6	13.6	13.6	13.4	13.3	13.0	13.0	13.0	13.1	13.3	13.6	13.6	13.3
1929	13.7	13.4	13.3	13.3	12.7	12.6	12.6	12.8	12.8	12.8	13.0	13.9	13.1
1930	13.2	13.1	13.0	13.0	12.4	13.0	13.0	12.8	12.6	12.4	12.4	12.3	12.8
1931	12.3	11.7	11.7	11.3	11.3	11.0	11.0	11.0	10.8	10.8	10.8	10.6	11.2
1932	10.1	10.0	10.0	10.0	9.6	9.0	8.5	8.9	8.9	8.9	8.8	8.8	9.3
1933	9.0	9.0	9.0	8.4	8.4	8.2	9.2	10.0	10.0	10.0	10.0	10.0	9.3
1934	9.8	9.6	9.0	9.0	9.2	9.1	9.0	9.4	9.5	9.5	9.9	9.9	9.4
1935	9.9	10.2	10.3	10.1	10.1	9.5	9.4	9.4	9.5	9.5	9.5	9.6	9.8
1936	9.6	9.5	9.5	9.5	9.5	9.8	9.8	9.8	9.8	10.5	10.5	10.5	9.9
1937	10.5	10.3	10.2	10.2	10.2	10.0	10.1	10.1	10.1	10.0	10.1	10.3	10.2
1938	10.3	10.3	10.0	9.6	9.6	9.4	9.5	9.6	9.4	9.4	9.5	9.6	9.7
1939	9.6	9.6	9.6	9.6	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.2	9.8
1940	10.1	10.1	10.1	10.1	10.0	10.0	9.9	9.9	10.0	10.0	10.2	10.2	10.0
1941	10.2	10.2	10.1	10.1	10.1	10.1	10.2	10.4	11.4	11.4	11.4	11.5	10.6
1942	11.7	11.3	11.4	11.4	11.5	11.7	11.7	11.7	11.9	11.9	12.1	12.3	11.7
1943	12.4	12.6	12.8	12.9	12.4	12.8	12.8	12.8	12.9	13.0	13.0	13.0	12.8
1944	13.0	13.0	13.0	13.0	12.7	12.5	13.0	13.1	13.1	13.2	13.2	13.3	13.0
1945	13.3	13.3	13.3	13.3	13.2	13.2	13.3	13.4	13.5	13.5	13.5	13.6	13.4
1946	13.6	13.6	13.6	13.6	13.6	14.0	15.2	15.3	16.3	17.0	17.5	17.5	15.1
1947	17.5	17.5	17.5	17.4	17.4	17.4	17.5	17.5	18.0	18.5	19.0	19.0	17.8

Table 54. Butter: Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	24	24	26	26	26	......
1910	26	27	27	26	26	26	25	25	24	24	26	26	26
1911	26	26	26	25	25	25	24	24	26	26	26	27	26
1912	29	29	28	28	28	26	26	27	27	28	29	30	28
1913	28	28	28	27	28	28	28	28	27	28	28	28	28
1914	28	28	28	28	28	28	28	28	28	28	28	28	28
1915	29	29	28	28	28	28	28	28	28	29	29	30	28
1916	29	28	28	28	28	29	29	29	28	30	32	32	29
1917	33	33	33	34	34	34	34	34	34	36	38	41	35
1918	45	44	40	38	38	38	39	40	42	46	48	52	42
1919	52	48	46	48	51	46	42	44	44	46	52	56	48
1920	54	50	51	50	48	48	48	48	50	52	51	54	50
1921	52	46	44	44	40	36	34	36	38	40	40	40	41
1922	41	38	36	37	36	34	34	34	34	36	38	40	36
1923	40	39	40	40	40	40	38	40	41	42	44	45	41
1924	47	50	46	44	46	42	41	44	45	44	44	48	45
1925	42	40	41	45	45	44	42	41	45	44	47	47	44
1926	43	44	43	42	42	45	41	41	42	42	45	46	43
1927	45	46	43	45	42	43	43	43	45	45	44	47	44
1928	45	44	44	44	44	43	41	42	42	44	43	44	43
1929	41	42	42	43	42	41	42	43	43	43	45	42	42
1930	42	42	42	42	42	41	40	40	39	41	41	38	41
1931	36	34	34	33	32	30	29	28	29	30	29	32	31
1932	29	26	25	25	22	21	21	22	22	22	21	22	23
1933	22	21	20	21	21	22	23	22	22	23	24	24	22
1934	23	24	24	23	23	24	23	24	26	26	27	27	24
1935	28	31	29	29	28	27	27	28	28	28	30	30	29
1936	31	29	29	27	27	27	29	30	29	30	31	32	29
1937	31	29	30	30	30	29	29	29	29	30	31	31	30
1938	30	28	28	28	27	25	25	27	27	28	28	28	27
1939	27	27	26	26	26	26	25	24	26	27	27	27	26
1940	27	27	26	26	27	26	27	27	27	27	27	29	27
1941	29	29	28	28	29	29	31	30	32	32	34	35	30
1942	34	33	33	34	34	34	34	34	36	37	38	42	35
1943	42	44	44	44	44	45	45	45	45	46	48	48	45
1944	47	47	46	46	46	44	44	44	45	45	46	49	46
1945	48	47	47	47	47	47	48	48	48	49	50	50	48
1946	51	51	51	51	51	54	65	65	63	65	71	73	59
1947	68	64	64	63	62	59	60	61	68	68	69	74	65

Table 55. Butterfat: Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	24	25	27	28	29	......
1910	29	27	28	27	25	25	25	26	26	27	28	26	27
1911	25	24	22	20	19	20	22	22	23	26	29	31	24
1912	32	29	29	28	26	24	23	24	25	26	28	30	27
1913	30	30	31	28	26	25	24	25	28	28	29	30	28
1914	29	27	25	23	24	24	25	26	27	28	29	29	26
1915	29	28	26	27	25	25	24	22	24	26	28	30	26
1916	28	29	29	27	25	25	25	26	27	29	33	33	28
1917	34	35	36	36	33	32	32	33	35	36	37	40	35
1918	42	41	38	36	37	37	38	41	45	50	56	58	43
1919	55	49	52	54	49	47	47	49	52	59	62	64	53
1920	61	60	59	56	54	49	48	50	52	54	55	58	55
1921	57	44	44	44	37	32	31	30	35	40	40	42	40
1922	42	41	37	39	37	35	35	35	35	38	42	43	38
1923	44	44	45	43	42	38	38	39	40	41	42	44	42
1924	44	42	41	40	39	38	37	38	40	40	40	41	40
1925	40	38	38	38	38	37	36	35	36	37	38	40	38
1926	40	39	38	38	38	38	39	39	38	38	42	48	40
1927	42	38	39	42	38	39	40	38	42	44	46	43	41
1928	47	42	39	40	41	43	41	40	42	40	42	39	41
1929	41	43	44	40	41	41	40	42	41	42	39	39	41
1930	38	38	36	36	38	34	36	35	35	35	32	31	35
1931	28	24	27	25	23	23	23	25	23	24	27	21	24
1932	20	19	17	17	15	14	14	14	14	14	14	14	16
1933	15	15	15	15	15	16	17	16	16	17	16	16	16
1934	15	17	17	17	18	18	18	18	19	22	23	22	19
1935	23	28	25	28	25	24	22	22	22	22	22	24	24
1936	26	26	26	26	22	24	29	30	29	27	28	27	27
1937	31	30	30	28	27	28	28	28	28	30	31	31	29
1938	27	27	27	24	21	22	22	22	21	21	21	22	23
1939	21	21	21	20	21	21	20	20	21	21	23	24	21
1940	26	26	24	24	24	24	24	24	25	25	25	27	25
1941	26	26	26	26	30	30	30	30	31	31	33	34	29
1942	33	32	32	32	33	33	33	33	34	35	36	40	34
1943	41	41	40	40	40	39	39	41	41	43	45	45	41
1944	45	45	45	45	44	43	43	43	45	45	47	47	45
1945	47	47	47	46	46	46	47	47	47	48	48	48	47
1946	47	47	47	47	47	47	55	55	57	65	71	73	55
1947	65	61	61	61	59	56	56	61	68	68	69	72	63

Table 56. **Wool:** Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	23	24	24	24	24	......
1910	23	24	22	20	25	22	23	21	16	19	18	17	21
1911	14	18	17	18	17	14	14	15	17	15	15	15	16
1912	15	15	16	14	15	17	16	16	18	16	15	13	16
1913	16	15	13	15	13	12	15	15	15	15	13	14	14
1914	15	14	14	14	10	16	16	15	17	18	14	14	15
1915	16	14	15	16	14	16	15	17	13	17	14	16	15
1916	17	18	14	16	23	25	20	22	20	18	18	18	19
1917	17	19	22	27	30	38	45	43	43	36	35	42	33
1918	38	42	37	39	44	44	48	46	47	50	50	46	44
1919	44	40	39	38	37	36	37	35	38	39	40	35	38
1920	34	34	34	34	33	25	21	19	18	13	10	10	24
1921	10	10	11	15	10	12	10	10	11	14	11	11	11
1922	13	12	11	12	16	16	15	15	14	18	16	18	15
1923	23	18	18	19	20	21	22	24	25	28	31	34	24
1924	30	30	30	30	28	28	26	33	34	33	35	36	31
1925	37	38	39	40	40	40	37	35	35	35	35	36	37
1926	38	36	33	30	25	25	27	28	30	30	34	28	30
1927	30	31	30	26	26	26	28	28	30	31	30	29	29
1928	29	31	31	30	32	34	37	37	35	35	34	34	33
1929	34	31	34	34	33	31	29	31	33	32	30	32	32
1930	33	33	28	29	24	20	20	23	21	22	22	20	25
1931	19	18	17	17	15	14	12	12	11	12	13	11	14
1932	10	9	12	9	7	6	6	7	10	10	9	9	9
1933	9	8	8	8	11	18	20	19	19	19	20	20	15
1934	21	22	22	21	21	20	21	20	21	19	21	22	21
1935	20	20	19	17	17	19	22	21	21	21	23	23	20
1936	22	21	21	21	22	24	23	23	24	25	26	26	23
1937	28	28	28	29	31	31	31	35	33	29	29	28	30
1938	27	26	23	21	22	19	19	19	19	20	21	21	21
1939	21	21	21	20	20	22	22	21	24	24	23	23	22
1940	25	24	24	21	25	25	27	27	26	28	29	29	26
1941	28	29	29	32	34	36	36	32	33	34	34	34	33
1942	34	34	34	34	38	38	40	40	40	40	40	40	38
1943	40	40	40	40	42	45	42	42	41	41	41	41	41
1944	43	42	42	42	43	44	46	48	50	48	46	44	45
1945	41	41	42	42	42	42	42	44	46	48	49	51	44
1946	46	48	48	48	48	47	48	48	48	47	47	47	47
1947	45	43	43	43	43	39	40	42	42	42	42	45	42

Table 57. Cottonseed: Average Price Per Ton Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1909	......	......	......	......	......	......	......	21.00	20.00	23.00	25.00	26.50	......
1910	26.20	26.00	27.00	28.00	28.50	29.00	28.50	25.80	25.80	26.30	24.80	24.90	26.70
1911	26.20	24.50	24.30	24.50	22.50	20.30	21.20	24.00	18.00	17.00	18.90	18.50	21.70
1912	17.18	18.40	18.30	18.10	19.30	17.00	18.30	19.30	18.10	18.40	19.19	19.70	18.40
1913	20.20	21.80	21.50	21.70	22.50	19.60	18.50	20.00	19.70	19.00	18.00	18.50	20.10
1914	17.60	18.00	18.20	20.10	22.10	18.00	20.00	21.00	13.20	16.10	13.60	17.80	18.00
1915	19.00	20.50	20.60	20.20	21.10	19.80	19.00	17.00	21.10	30.60	34.10	34.60	23.10
1916	35.00	40.00	34.80	40.70	32.50	35.00	36.50	36.50	36.50	45.00	57.00	57.00	40.50
1917	50.00	45.30	52.70	55.30	58.40	58.00	54.30	60.00	53.50	62.50	66.30	65.75	56.80
1918	66.25	67.20	68.80	69.00	71.00	68.50	65.00	57.00	67.00	67.00	64.00	61.00	66.00
1919	61.00	61.00	62.10	63.00	63.00	62.40	62.00	63.00	60.00	62.90	69.70	68.60	63.20
1920	66.10	65.00	71.00	75.00	70.80	66.70	65.00	55.40	34.70	27.90	27.80	21.40	53.90
1921	20.40	19.50	19.10	18.70	17.20	18.10	17.50	21.40	26.60	28.00	29.10	24.60	21.70
1922	25.60	25.80	25.50	32.70	33.50	33.40	29.80	25.00	27.00	27.90	34.70	42.60	30.30
1923	38.00	35.00	35.00	38.70	37.80	36.00	38.00	40.00	40.00	40.00	42.00	41.00	38.50
1924	40.00	39.00	45.00	43.00	41.50	40.00	40.00	35.00	31.00	30.00	30.50	32.00	27.20
1925	35.00	33.50	34.00	33.60	35.50	32.00	40.00	32.30	33.20	29.70	24.50	23.00	32.20
1926	25.00	27.80	28.10	27.60	27.10	29.30	32.80	28.00	25.10	18.30	17.70	17.40	25.40
1927	18.10	22.20	23.00	24.40	24.10	24.00	25.00	25.20	33.70	34.60	34.20	36.00	27.00
1928	36.50	35.00	35.00	36.00	39.00	39.00	39.00	37.00	30.00	32.00	35.00	35.00	35.70
1929	35.00	35.00	37.00	36.00	35.00	34.00	33.00	29.00	29.00	31.00	30.00	31.00	32.90
1930	31.00	30.00	31.00	31.00	31.00	29.00	27.00	23.00	23.00	19.00	19.00	19.00	26.10
1931	20.00	20.00	21.00	21.00	21.00	19.00	19.40	13.60	8.00	6.50	8.80	9.10	15.60
1932	9.40	9.30	9.80	9.50	9.20	8.30	8.50	8.50	10.60	10.20	9.30	9.00	9.30
1933	9.10	9.00	9.20	10.00	11.50	12.00	14.00	14.00	11.50	12.75	12.90	13.00	11.60
1934	15.50	16.00	17.75	18.00	19.00	18.50	19.00	25.00	33.00	34.00	36.00	36.00	24.00
1935	38.00	38.00	38.00	36.00	37.00	36.50	36.00	29.00	29.00	33.00	34.00	34.00	34.00
1936	34.00	34.00	34.00	35.00	34.00	33.00	33.00	33.00	34.00	34.00	34.00	35.00	33.90
1937	36.00	37.00	37.00	38.00	38.00	35.00	34.00	24.00	18.00	17.00	18.00	18.00	29.20
1938	17.00	19.00	20.00	20.00	29.00	21.00	21.00	21.00	20.00	22.00	22.20	23.00	21.30
1939	23.00	23.00	22.30	23.00	22.50	23.00	20.50	13.40	20.30	22.20	22.20	23.10	21.50
1940	24.20	24.70	25.20	25.50	25.50	24.40	24.00	22.00	19.70	20.50	22.00	22.80	23.40
1941	24.40	24.00	25.00	26.20	27.80	28.90	34.20	35.60	47.00	52.00	49.00	48.20	35.20
1942	47.90	48.20	48.80	49.20	49.00	46.00	46.00	45.00	44.00	45.00	44.00	44.00	46.40
1943	45.00	45.00	46.00	46.50	47.10	47.30	46.50	51.00	52.00	52.00	51.00	49.00	48.20
1944	50.00	50.00	51.00	51.00	51.00	52.00	53.00	51.00	51.00	49.00	50.00	50.00	50.80
1945	51.00	51.00	51.00	52.00	52.00	53.00	53.00	51.00	49.00	50.00	51.00	52.00	51.30
1946	52.00	51.00	51.00	52.00	52.00	53.00	57.00	58.00	58.00	63.00	91.00	93.00	60.90
1947	91.00	89.00	91.00	90.00	84.00	74.00	74.00	69.00	76.00	89.00	87.00	89.00	83.60

Table 58. Peanuts: Average Price Per Pound Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	3.6	3.6	3.6	3.5	3.4	......
1910	2.9	3.0	3.7	3.5	3.2	3.4	4.0	3.1	3.2	3.5	3.2	3.0	3.3
1911	5.0	4.5	4.0	4.5	4.5	4.2	5.0	4.7	4.7	4.8	3.7	4.0	4.5
1912	3.2	3.9	3.9	5.0	4.0	5.0	5.0	4.1	2.5	4.0	3.5	3.0	3.9
1913	3.7	3.2	2.9	4.0	4.3	5.0	5.0	4.0	4.0	4.7	3.8	3.9	4.0
1914	4.0	4.0	3.5	4.0	3.5	5.0	7.0	5.0	4.0	3.7	4.0	3.9	4.3
1915	7.0	4.0	2.5	6.0	5.6	5.3	5.0	6.5	7.0	6.0	5.0	4.2	5.3
1916	4.5	5.0	4.4	4.0	4.0	4.5	5.0	5.5	4.5	4.5	4.4	4.8	4.6
1917	5.2	4.5	6.0	5.4	7.0	6.0	5.3	5.0	5.0	5.5	6.0	6.5	5.6
1918	7.0	7.3	7.0	6.0	6.4	8.5	6.0	6.0	6.0	6.0	6.5	7.0	6.6
1919	6.0	7.9	8.6	8.6	8.7	8.4	8.0	7.0	9.0	10.0	9.0	10.0	8.4
1920	9.0	9.0	11.0	10.0	10.0	12.0	10.3	10.0	6.0	9.0	5.5	5.5	8.9
1921	8.0	6.0	6.4	6.0	7.0	5.0	6.0	7.0	8.0	7.0	6.0	6.0	6.5
1922	7.5	5.4	7.0	6.1	6.3	10.3	7.2	8.5	5.4	5.4	6.9	6.9	6.9
1923	5.4	6.5	6.0	6.0	6.0	7.0	7.0	7.0	7.0	8.0	7.5	7.0	6.7
1924	6.5	6.5	6.8	6.5	6.2	6.0	6.0	5.0	6.0	6.0	6.0	6.6	6.2
1925	6.5	6.5	7.0	6.5	8.2	7.2	8.1	7.6	7.0	6.0	5.9	6.3	6.9
1926	6.4	6.4	6.5	5.6	6.5	7.0	7.5	6.9	8.0	7.5	6.0	6.4	6.7
1927	6.5	7.3	6.5	5.7	6.8	7.5	8.3	7.0	7.4	7.4	7.5	6.8	7.1
1928	6.6	7.6	7.8	8.1	8.6	7.7	7.7	7.7	6.6	6.8	7.3	7.0	7.5
1929	7.6	7.1	6.9	7.1	7.4	7.9	7.7	7.6	7.0	6.6	6.6	6.8	7.2
1930	7.0	6.4	6.4	6.4	7.0	6.5	6.7	6.5	6.8	6.5	6.9	6.5	6.6
1931	6.2	5.3	6.0	6.0	6.5	6.1	5.5	5.5	4.5	4.0	3.8	3.9	5.3
1932	3.6	3.7	3.8	4.0	4.2	3.8	4.3	4.0	3.9	3.9	3.7	3.8	3.9
1933	3.5	3.6	3.7	4.1	4.2	4.2	4.6	3.9	4.2	4.7	4.3	4.1	4.1
1934	4.4	4.8	4.4	4.5	4.7	4.4	4.5	4.0	4.2	4.0	4.0	4.6	4.4
1935	4.7	4.7	5.1	5.4	4.8	4.6	5.0	4.8	4.8	4.7	4.6	4.8	4.8
1936	4.6	5.5	4.9	4.7	4.8	4.2	6.0	4.3	4.5	5.1	5.2	5.6	5.0
1937	5.6	5.3	4.9	5.7	5.6	5.5	5.4	5.4	5.1	4.8	4.8	4.8	5.2
1938	4.8	4.9	5.4	5.4	5.6	5.7	5.6	5.4	4.9	4.8	4.6	4.9	5.2
1939	5.0	5.2	5.2	5.2	5.3	5.4	5.4	5.4	5.7	5.3	5.5	5.2	5.3
1940	4.7	4.9	4.9	5.2	5.6	5.4	5.6	5.6	5.0	4.8	5.0	4.9	5.1
1941	4.9	5.1	4.9	5.0	5.0	5.0	5.0	5.3	5.3	5.3	5.7	5.8	5.2
1942	5.8	5.9	6.7	7.2	7.1	6.6	6.6	6.9	5.0	5.0	5.0	5.3	6.1
1943	5.5	5.8	6.0	6.5	7.0	7.0	7.0	7.0	7.0	7.5	7.1	7.5	6.7
1944	7.5	8.2	8.2	8.5	8.5	8.5	8.5	9.0	8.3	8.2	8.5	8.5	8.4
1945	8.5	8.4	8.7	8.7	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.9
1946	9.0	9.5	9.7	9.8	10.1	10.2	10.2	10.2	10.2	10.2	11.2	10.8	10.1
1947	10.8	10.8	11.4	12.5	12.0	12.0	12.0	12.0	12.5	12.5	13.0	13.0	12.0

Table 59. Soybeans: Average Price Per Bushel Received by Louisiana Farmers, January 1937—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1937	2.10	2.05	2.05	2.55	2.60	2.50	2.30	1.90	1.80	1.60	1.50	1.40	2.05
1938	1.30	1.30	1.35	1.35	1.45	1.50	1.50	1.40	1.40	1.25	1.15	1.15	1.35
1939	1.25	1.25	1.35	1.35	1.60	1.50	1.35	1.25	1.25	1.15	.90	1.00	1.25
1940	1.05	1.25	1.25	1.35	1.50	1.55	1.40	1.15	1.10	1.05	.95	1.20	1.25
1941	1.35	1.45	1.55	1.55	1.50	1.55	1.60	1.50	1.60	1.50	1.55	1.65	1.55
1942	1.90	2.05	2.30	2.50	2.50	2.50	2.50	2.30	2.00	1.95	1.75	1.75	2.15
1943	1.85	2.00	2.20	2.30	2.40	2.35	2.05	2.10	2.10	1.95	1.95	2.05	2.10
1944	2.30	3.00	3.40	3.60	3.60	3.50	2.80	2.80	2.60	2.40	2.40	2.50	2.90
1945	2.90	2.90	3.25	3.50	3.50	3.50	3.25	3.25	3.00	2.65	2.55	2.55	3.05
1946	2.55	2.60	2.90	3.10	2.90	3.15	3.15	2.95	2.80	2.50	3.00	3.00	2.90
1947	3.15	3.10	3.50	3.60	3.60	3.60	3.45	3.30	3.50	3.00	3.15	3.50	3.35

Table 60. Irish Potatoes: Average Price Per Bushel Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	85	90	92	92	94	......
1910	101	110	108	95	82	70	66	74	79	83	89	85	87
1911	88	95	96	88	80	80	84	101	110	112	106	100	95
1912	104	106	110	125	125	105	90	88	89	80	79	86	99
1913	94	101	110	112	108	92	76	78	86	100	103	96	96
1914	98	108	112	104	100	93	86	95	100	104	104	104	101
1915	110	112	114	111	111	106	92	90	90	94	99	88	101
1916	87	112	140	137	114	102	94	100	125	157	171	174	126
1917	185	231	280	292	276	262	241	230	220	193	187	185	232
1918	190	216	224	198	134	86	96	122	143	153	158	165	157
1919	188	184	176	190	200	180	162	159	152	182	218	228	185
1920	260	316	328	360	310	345	265	280	242	218	207	200	278
1921	190	194	202	165	155	150	140	159	172	184	188	184	174
1922	194	230	251	185	156	131	140	140	142	168	175	150	172
1923	152	177	215	203	160	145	145	135	148	162	160	155	163
1924	184	150	125	140	135	145	115	120	165	160	160	140	145
1925	149	150	150	145	133	170	175	210	216	193	293	276	188
1926	238	280	280	280	255	143	132	170	150	150	160	180	202
1927	190	190	190	255	130	155	195	170	170	155	155	155	176
1928	150	150	160	160	117	70	90	85	85	110	115	115	117
1929	125	135	130	165	160	130	145	150	170	170	165	160	150
1930	155	160	160	225	138	130	130	135	165	145	130	130	150
1931	130	125	125	110	80	50	50	50	60	60	85	90	85
1932	89	80	95	120	105	55	55	55	65	80	60	70	77
1933	60	65	80	100	74	75	80	120	140	105	105	90	91
1934	115	115	130	90	73	38	60	75	75	75	90	100	86
1935	105	95	95	140	60	60	75	65	75	80	85	85	85
1936	90	80	95	125	115	145	120	130	130	130	140	135	120
1937	135	160	110	70	45	50	60	75	80	80	85	85	86
1938	85	95	90	60	60	55	60	70	80	75	80	95	75
1939	95	85	105	110	65	60	65	80	110	95	90	95	88
1940	100	110	110	115	81	78	80	85	80	85	95	85	92
1941	80	85	85	110	61	55	60	70	85	95	100	110	83
1942	125	140	140	160	120	80	95	125	120	130	130	135	125
1943	135	145	165	235	152	160	161	170	180	185	185	195	172
1944	195	195	205	135	125	110	110	145	165	180	170	170	159
1945	175	190	215	195	190	184	210	230	210	200	185	180	197
1946	200	200	215	195	130	115	170	190	190	200	200	190	183
1947	190	185	200	200	180	150	155	165	175	185	185	215	182

Table 61. **Sweet Potatoes:** Average Price Per Bushel Received by Louisiana Farmers, August 1909—December 1947

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Average
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1909	......	......	......	......	......	......	......	80	80	71	62	58	......
1910	60	60	64	68	63	59	66	78	81	71	58	55	65
1911	62	65	70	79	82	76	90	79	79	72	60	57	73
1912	65	68	80	92	83	79	85	84	85	72	66	59	76
1913	70	75	79	86	90	80	70	80	75	70	65	60	75
1914	70	65	75	79	80	80	88	85	71	70	58	52	73
1915	55	62	69	74	85	80	79	76	65	55	43	48	66
1916	56	57	63	65	65	65	80	79	71	63	60	60	65
1917	65	70	95	95	100	100	100	100	115	100	95	100	95
1918	100	120	150	148	125	100	115	140	135	150	140	117	128
1919	130	160	165	200	170	170	180	210	220	130	120	110	164
1920	150	160	160	180	190	250	200	200	189	123	89	90	165
1921	99	90	90	131	112	116	154	109	85	82	69	65	100
1922	70	73	85	96	90	103	121	106	88	84	58	51	85
1923	83	93	106	106	109	104	93	108	162	118	104	100	107
1924	110	150	130	125	160	150	130	170	175	156	165	173	150
1925	150	190	246	340	308	200	183	176	208	208	134	99	204
1926	146	131	145	150	180	150	110	160	140	120	70	80	132
1927	90	110	110	110	110	130	115	120	125	90	80	95	107
1928	85	85	95	105	105	105	95	95	100	85	85	85	94
1929	85	105	110	105	120	145	145	140	125	110	95	100	115
1930	100	100	105	120	140	140	130	135	125	115	95	95	117
1931	90	90	95	110	110	85	80	95	75	65	55	45	83
1932	55	55	55	50	50	50	50	55	46	45	40	40	49
1933	40	41	43	46	65	65	65	90	70	60	50	60	58
1934	65	65	65	65	70	85	70	80	85	70	65	65	71
1935	65	70	80	80	85	80	85	75	60	55	50	50	70
1936	55	55	55	60	70	75	90	125	80	90	75	75	75
1937	80	85	95	110	110	100	85	80	80	65	60	65	85
1938	65	70	75	70	80	85	75	85	60	55	50	55	69
1939	55	65	65	70	80	80	85	80	60	55	50	55	67
1940	55	70	75	75	75	85	85	90	85	75	65	70	75
1941	70	80	80	85	85	90	95	90	80	70	60	65	79
1942	70	75	75	75	75	80	90	135	105	100	85	100	89
1943	110	115	160	165	180	180	450	220	195	180	160	150	189
1944	155	165	180	190	210	220	195	190	125	135	125	135	169
1945	155	170	175	175	200	200	225	225	95	110	135	160	169
1946	160	190	210	220	235	245	245	200	120	140	150	175	191
1947	175	190	170	170	160	220	180	225	150	120	135	165	172

Table 62. Season Average Prices Received by Louisiana Farmers for Crops not Marketed Throughout the Year, 1909-1947

Year	Sugar cane	Syrup	Oranges	Pears	Peaches	Strawberries 24 pt. crate	Pecans	Cabbage	Spring beans	Fall beans	Carrots	Watermelons	Onions †	Green peppers	Tomatoes	Truck Crops for Processing
	Dol. per ton	Dol. per gal.	Dol. per box	Dol. per bu.	Dol. per bu.	Dol. per cr.	Cents per lb.	Dol. per ton	Dol. per bu.	Dol. per bu.	Dol. per bu.	Dol. 1000	Dol. per sack	Dol. per bu.	Dol. per bu.	Dol. per ton
1909	3.83	.40	......	......	.78	......	......	......	......	......	......	......	......	......	......	......
1910	3.69	.44	......	......	1.00	......	......	......	......	......	......	......	......	......	......	......
1911	4.29	.44	......	......	1.00	......	......	......	......	......	......	......	......	......	......	......
1912	3.73	.41	......	......	.80	......	......	......	......	......	......	......	......	......	......	......
1913	3.13	.43	......	......	1.50	......	......	......	......	......	......	......	......	......	......	......
1914	3.75	.43	......	......	1.00	......	......	......	......	......	......	......	......	......	......	......
1915	4.55	.48	......	......	.95	......	......	......	......	......	......	......	......	......	......	......
1916	5.29	.55	......	......	.85	......	......	......	......	......	......	......	......	......	......	......
1917	7.10	.59	......	......	1.25	......	......	......	......	......	......	......	......	......	......	......
1918	7.28	.68	......	......	1.40	2.88	......	55.00	2.25	......	......	......	1.60	......	......	......
1919	14.00	1.07	2.79	1.25	1.80	3.12	29.0	52.50	2.35	......	......	......	2.85	......	......	......
1920	5.76	.96	1.74	1.75	2.70	3.35	31.0	40.20	2.25	......	......	......	1.86	......	......	......
1921	3.63	.54	2.39	2.29	1.45	3.25	21.0	22.50	2.75	......	......	......	.95	......	......	......
1922	5.83	.49	2.29	1.71	1.45	2.15	21.7	20.00	1.60	1.75	......	......	1.51	......	......	......
1923	7.09	.59	.84	1.70	1.90	3.00	18.7	42.70	2.55	1.85	.78	......	1.79	......	......	......
1924	5.58	.43	1.72	1.90	1.85	3.25	26.3	48.80	1.80	1.85	1.03	......	.89	1.30	......	......
1925	4.05	.35	2.23	1.45	1.75	3.00	19.8	22.50	1.35	1.85	.70	......	1.36	1.20	3.00	......
1926	4.92	.41	2.11	1.30	1.50	3.48	17.3	35.20	2.15	1.65	.70	......	1.17	1.40	1.80	......
1927	4.61	.44	3.51	1.40	1.80	2.75	20.3	21.80	1.35	1.30	.51	......	1.22	1.20	1.00	......
1928	3.86	.37	2.50	1.35	1.60	3.01	13.9	23.10	1.55	1.55	.51	......	.88	.90	1.25	61.40
1929	3.77	.41	2.86	1.35	1.70	2.21	18.2	22.10	1.35	1.10	.62	......	1.08	.93	1.25	46.00
1930	3.38	.36	1.53	1.30	1.75	2.56	14.4	35.80	1.05	1.03	.50	......	1.15	.70	1.10	32.40
1931	3.29	.39	1.33	.90	1.05	2.06	9.4	16.60	.81	.95	.31	......	1.00	.65	1.25	32.20
1932	3.06	.34	1.28	.70	1.05	1.21	8.3	26.50	.55	.60	.40	......	.80	.85	1.45	23.80
1933	3.29	.33	1.44	1.00	1.10	1.30	7.0	21.60	.32	.68	.37	......	.88	.60	.90	18.80
1934	2.33	.37	1.06	.55	.75	1.38	12.4	10.60	.72	.80	.32	85	.50	.48	.70	21.60
1935	3.18	.40	1.62	.75	1.05	1.68	8.7	23.00	.71	1.00	.60	90	.83	.49	.75	16.60
1936	3.71	.36	1.62	.65	1.10	1.74	12.2	18.50	1.20	.90	.40	100	.88	.48	1.00	21.10
1937	2.91	.41	1.37	.70	1.25	1.53	8.2	23.00	1.15	1.35	.60	96	.65	.60	1.25	21.70
1938	2.65	.37	1.00	.50	1.00	1.75	9.5	14.60	.70	.80	.40	113	.72	.40	.60	22.40
1939	2.80	.41	1.10	.70	1.05	1.68	9.6	20.50	.90	.95	.45	143	.70	1.10	1.15	26.80
1940	2.69	.38	1.00	.50	1.00	1.81	9.7	24.00	1.15	.65	.55	156	1.30	.80	.80	24.00
1941	3.92	.56	1.20	.60	1.05	1.42	10.0	22.00	1.25	1.65	.55	169	1.08	.60	1.15	27.00
1942	4.35	.65	2.25	.65	1.30	2.05	15.4	16.50	1.40	1.90	.80	225	.88	1.15	1.80	37.70
1943	4.60	.74	3.40	1.70	3.10	3.62	20.0	67.50	2.30	2.40	1.05	435	1.65	3.25	3.50	65.40
1944	5.10	.66	2.60	1.45	3.00	4.92	18.6	28.00	2.25	2.45	1.15	500	2.60	1.90	3.25	59.50
1945	5.58	.68	2.55	1.30	2.95	5.05	21.2	26.00	2.50	2.75	1.30	520	2.10	2.20	3.35	56.15
1946	6.55	1.20	1.90	1.50	3.05	5.20	30.8	40.00	2.10	2.40	1.50	420	2.20	2.20	3.50	70.35
1947	7.40	.80	1.50	1.45	2.85	4.48	27.0	19.80	2.30	2.45	1.45	356	1.70	2.80	2.55	55.85

† 50 lb. sack.

TECHNOLOGY AND SCIENCE ROOM

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LOUISIANA BULLETIN NO. 430 JUNE 1948

Herbicidal Tests on Sweet Potatoes and Several Wild Host Plants of the Sweet Potato Weevil

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By

C. E. SMITH, K. L. COCKERHAM, AND O. T. DEEN

WARNING!

USE 2,4-D COMPOUNDS WITH CARE

The herbicide 2,4-D was found to be very effective in killing sweet potatoes and morning-glories. It should prove valuable in destroying volunteer sweet potato plants, discarded plant beds, mother rows and wild morning-glories *provided it is used with extreme care.* Such crops as cotton, okra, tomatoes, legume crops and ornamentals are sensitive to 2,4-D poisoning and may be severely damaged by drift from sprays and dusts applied some distance away. Sprayers and dusters that have been used to apply 2,4-D should never be used to apply fungicides and insecticides on susceptible crops or plants.

TECHNOLOGY AND SCIENCE ROOM

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

HERBICIDAL TESTS ON SWEET POTATOES AND SEVERAL WILD HOST PLANTS OF THE SWEET POTATO WEEVIL

By

C. E. Smith*

Louisiana Agricultural Experiment Station

and

K. L. Cockerham and O. T. Deen

U. S. D. A., Agricultural Research Administration

Bureau of Entomology and Plant Quarantine

The sweet potato weevil, *Cylas formicarius elegantulus* (Sum.), breeds in several species of morning-glories which belong to the same genus as the sweet potato, *Ipomoea.* Morning-glories are not killed below the surface of the ground during the mild winters which usually prevail in the area inhabited by this insect, namely the southern one-third to two-fifths of Louisiana. Therefore, these wild plants, together with volunteer plants and crop remnants of sweet potatoes, provide excellent overwintering host materials in the field. This is one of the most important factors involved in the control and eradication of the sweet potato weevil. The need for a chemical that could be used in destroying these field hosts has been recognized for a long time.

In 1918-20 the senior author studied the use of different chemical preparations as herbicides against morning-glories, and the results were reported in Louisiana Bulletin No. 188. In 1944 the field laboratory of the Bureau of Entomology and Plant Quarantine at Opelousas inaugurated similar studies which included sweet potato plants and discarded seedbeds or "mother" rows. In 1945, after the Federal laboratory was moved to Baton Rouge, the Department of Entomology of the Louisiana Agricultural Experiment Station collaborated in the study, devoting its efforts largely toward testing chemicals for destroying sweet potato vines just prior to digging time. The objective was twofold, namely (1) to evaluate chemicals as herbicides for killing the vines, thus eliminating them as an overwintering medium; and (2) to study the penetrating effects of the chemicals into the roots of the plants, thus determining their possible value for use in field and wild host-plant eradication. The purpose of this paper is to report the results obtained in these studies.

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* T. C. Barber and P. T. Dutsch of the Louisiana Agricultural Experiment Station assisted in the field work of experiments conducted by the Experiment Station.

Studies Conducted at Opelousas, Louisiana, during 1944

These studies consisted of testing sodium fluoride and calcium fluosilicate as herbicides against sweet potato and morning-glory plants. The chemicals were used as dusts and, with one exception, on plants moist with dew or sprinkled with water. The dusts were applied with small plunger-type hand dusters in the laboratory and with rotary-type shoulder dusters in the field. Observations on effects were made periodically over periods ranging from five days to several months.

The tests consisted of (1) potted sweet potato plants at the laboratory under outdoor conditions; (2) "mother" rows of sweet potatoes grown from cut and uncut potatoes, some of which were infested with the sweet potato weevil; (3) volunteer plants from roots and scrap potatoes left in the ground after the old seed potatoes in the "mother" rows were dug and removed; (4) sweet potato plants growing in the field under normal conditions; (5) plants of the perennial morning-glory, *Ipomoea pandurata* (L.) G. F. W. Mey; and (6) uncultivated land on which a fairly thick stand of *I. trichocarpa* Ell. and *I. hederacea* Jacq. was growing.

The results showed that both sodium fluoride and calcium fluosilicate were toxic to the vines of sweet potatoes and morning-glories. Each chemical killed nearly 100 per cent of the vines down to soil level. Observations indicated that sodium fluoride was slightly more toxic than calcium fluosilicate, especially to the roots of the young plants, as calcium fluosilicate killed comparatively few roots. Neither of these chemicals appeared to have any effect upon the tuberous roots of *I. pandurata* and the underground parts of old "mother" potatoes.

Tests on Destruction of Discarded Sweet Potato "Mother" Rows and Morning-glories

Two tests were conducted at Baton Rouge during 1946 in which 2,4-D (2,4-dichlorophenoxyacetic acid) spray was used, one on old "mother" row plants and the other on morning-glories. The treatments consisted of one application of a solution of 2,4-D, 1 ounce to 4 gallons of water. The applications were made July 25, and the observations on the effects of the treatments were for periods of one and three months, respectively.

Six days after the application on the sweet potato "mother" row, the vines showed a high degree of 2,4-D poisoning, the leaves were droopy, yellow, and dying. The "mother" potatoes also were showing the effect of the spray and were beginning to decay. In four weeks after the application, practically 100 per cent of the vines were dead and nearly 100 per cent of the old potatoes were decayed.

Approximately two weeks after the 2,4-D was applied in the test on the morning-glories, all the vines of *I. pandurata* had been killed down to the tuberous roots, and all the vines and roots of *I. trichocarpa* and *I. hederacea* Var. *integriuscula* Gray were completely dead. No new growth developed from the roots of *I. pandurata* during a period of about three months following the treatment, after which the roots of the treated plants were dug for examination.

These roots ranged in diameter from about ½ to 3½ inches and extended into the soil from 6 to 30 inches. The entire root systems of eight of the plants were decayed; the upper 1 to 4 inches of the remaining six were affected, but the remaining lower portions appeared normal.

Tests on Sweet Potatoes

Two experiments were conducted on sweet potatoes under field conditions, one in 1945 and one in 1946. The Porto Rico variety was used as the test crop, and was planted and cultivated similarly to commercial plantings.

1945 Experiment — The experiment consisted of 40 plots arranged in four randomized blocks — one plot for each of the nine herbicidal treatments and one untreated check. The plots were 50 feet long by 16 feet wide, consisting of four rows.

The treatments consisted of a single application of the chemicals, on October 19 - 20, except the superphosphate, which was applied at the time of digging. The dusts were applied with rotary-type shoulder dusters in early morning while the plants were moist with dew, and the liquid sprays with a small power sprayer during the day after the dew had dried from the plants.

Records were made on the progressive effects the chemicals had on the leaves, vines, and roots. The observations on the leaves and vines were made during the period between the application of the chemicals and the digging of the roots, and again about 60 days after the vines had been been covered in digging. The latter observation consisted of examination of the pieces of vines still alive, which had been uncovered with a plow in the center of the plots. The observations on the potatoes were started at digging time and continued in storage, being concluded on May 14, 1946, or about six months after the roots were dug. The samples were taken from the two middle rows of the plots and consisted of two bushels of sound roots per plot, or the amount produced when the total yield was less than two bushels. Replications A and D were dug on October 30, and replications B and C on November 6 — 11 and 12 days and 17 and 18 days, respectively, after the application.

The treatments, with the data obtained, are listed according to their effectiveness in killing the vines as determined by visual observations (Table 1).

Discussion — As indicated by the data in column 4 of Table 1, there was a relatively high correlation between the effectiveness of the treatments determined by visual observations, and the number of vines remaining alive after being turned under, with the exception of the 2,4-D treatments. The lack of correlation in the latter was doubtless due to the slow and long period of action of 2,4-D. The data in columns 5, 6, and 7 are self-evident: the 2,4-D treatments were very effective in destroying both the vines and roots. The data indicate also that none of the other treatments had any effect on the roots, since the check sustained a greater loss from decay than did any of the chemical treatments.

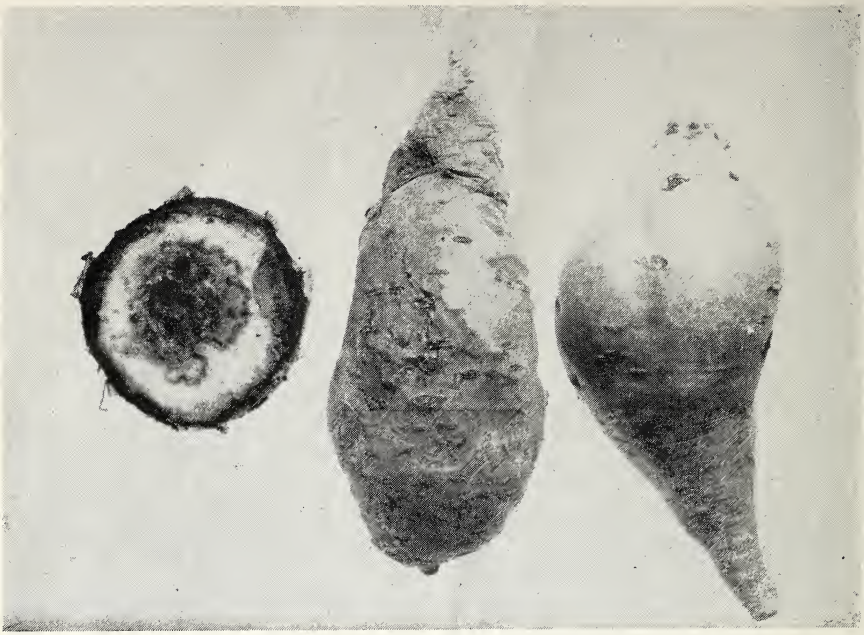

Fig. 1 — Sweet potatoes, left (cut) and center showing the effects (tissue breakdown and rot) resulting from 2,4-D treatment on vines before digging; right, sound root from unsprayed plant. (By personnel of Dept. of Botany.)

1946 Experiment — This experiment consisted of 48 plots arranged in four randomized blocks — one plot for each of 12 treatments, including the check. The plots were 50 feet long by 16 feet wide, consisting of four rows.

The treatments consisted of a single application of the chemicals, which was made November 1. The dusts were applied with rotary-type shoulder dusters early in the morning while the plants were dripping with dew, and the liquid sprays were applied during the day after the dew had dried from the plants. The 2,4-D solution was applied with a hand-pump wheelbarrow sprayer, and treatments 2, 3, and 4 with a 3½-gallon compressed-air sprayer. The vines or crowns in treatments 11, 10, 9, and 6 were cut with weeding hoes at the surface or slightly below, just before, within 2 hours after, one day after, and three days after the application.

Records were made on the progressive effects of the herbicides on the leaves, vines, and roots. The observations on the vines were started when the applications were made and continued for a period of about one month. The observations on the roots were started at digging time and were concluded March 19, 1947. The samples consisted of two bushels, or the amount of sound potatoes produced when the yield was less than two bushels, taken from the two inside rows of the plots, and were dug November 14 and 15 (Table 2).

Discussion — The ammonium sulfamate and oil (treatments 2 and 4) acted very quickly upon the foliage, and appeared to obtain their maximum effective-

TABLE 1 — Toxic Effect of Several Chemical Compounds on Sweet Potato Leaves, Vines, and Roots, Baton Rouge, 1945.

Chemical	Applications		Pieces of vines alive about 60 days after harvest	Roots showing breakdown at time of harvest	Roots placed in storage	Roots decayed in storage
	Dilution or concentration used	Rate per acre				
			Number	*Per cent*	*Number*	*Per cent*
1. Dinitro-O-sec-butyl phenol	3½ gals. to 100 gals.	100 gals.	11	7.0	242	3.7
2. Ammonium sulfamate	1 lb. to 1 gal.	100 gals.	9	0.0	340	3.2
3. Calcium fluosilicate	undiluted	90 lbs.	7	1.0	279	2.5
4. Sodium pentachlorophenate	8⅓ lbs. to 100 gals.	100 gals.	36	0.0	295	4.0
5. Sodium fluoride	undiluted	65 lbs.	3	0.0	293	3.4
6. 2,4-D spray[1]	1¼ lbs. to 100 gals.	100 gals.	1	32.0	256	90.2
7. 2,4-D spray[2]	1¼ gal. to 100 gals.	100 gals.	2	25.0	319	75.5
8. Ammonium salt of dinitro-O-sec-butyl phenol	½ gal. to 100 gals.	100 gals.	89	0.0	279	2.9
9. Superphosphate	undiluted	1000 lbs.	124	0.0	320	3.4
10. Check			148	0.0	293	6.1

[1] Commercial preparation said to contain 75 per cent of 2,4-dichlorophenoxyacetic acid.
[2] Commercial preparation said to contain 80 per cent of sodium 2,4-dichlorophenoxyacetate.

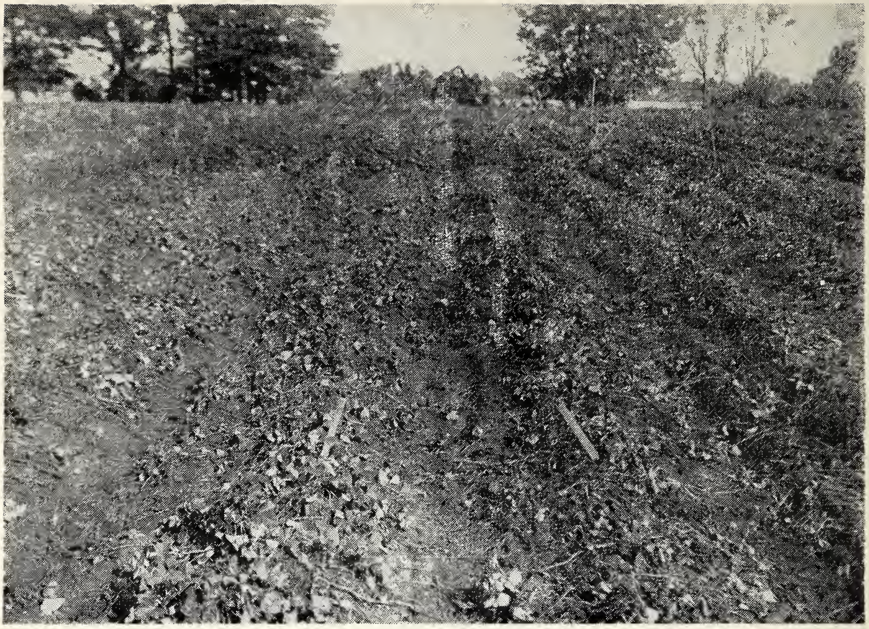

Fig. 2 — Sweet potato vines treated with 2,4-D: Left, with dust; right, with spray.

ness within three days after the application. Vines not killed in these treatments, except those of ammonium sulfamate, started putting out new growth in a week or ten days. Although some of the vines on the ammonium sulfamate plots appeared to be alive, very little new growth had started within 33 days after the application. During the first few days after the application, there appeared to be little or no difference between the effectiveness of the dust and the spray of 2,4-D. However, in 11 days the sprayed plants showed considerably more breakdown than did plants that were dusted (Figure 2). At this time there was no visible difference between the cut and uncut sprayed vines, but as time passed those cut appeared to disintegrate a little faster. A few of the uncut vines, especially on the dusted plots, showed a little sign of recovering after about a month.

On December 4, it was also noted that there were more and larger sprouts and new growth on the vines on the border rows in some of the 2,4-D plots than in others. An examination showed that the order of the treatments based on the number and size of the sprouts was treatments 11, 10, 9, and 6, respectively. This seems to indicate that the difference in effect resulted from the timing of the cutting of the vines.

To check further on the effects of the 2,4-D under the various ways it was used, 150 crowns on the border rows per treatment were examined and their condition recorded December 4. The results showed that in treatment 11, 2 per cent of the crowns were dead; in treatment 8, 26 per cent were dead; in treatment 10, 4.7 per cent were dead; in treatment 9, 18.7 per cent were dead; in treatment 6, 25 per cent were dead; and in treatment 7, 20.7 per cent were dead.

TABLE 2 — Toxic Effect of Several Chemical Compounds on Sweet Potato Leaves, Vines, and Roots, Baton Rouge, 1946.

Chemical	Applications		Roots showing breakdown at time of harvest	Roots placed in storage	Roots showing breakdown in storage
	Dilution or concentration used.	Rate per acre			
			Per cent	*Number*	*Per cent*
1. Calcium fluosilicate	undiluted	71 lbs.	0.0	637	3.2
2. Ammonium sulfamate	1 lb. to one gal.	78 gals.	0.0	628	3.2
3. Dinitro-O-sec-butyl phenol	3½ lbs. to 100 gals.	82 gals.	0.0	570	12.1
4. Oil, 50% aromatic hydrocarbons	undiluted	41 gals.	0.0	597	4.0
5. Sodium fluoride-clay	1 lb. to 1 lb.	56 lbs.	0.0	568	4.2
6. 2,4-D spray;[1] vines cut 3 days after spraying	1½ lbs. to 125 gallons	95 gals.	12.9	579	16.8
7. 2,4-D dust[2]	15 per cent	25 lbs.	10.8	599	36.1
8. 2,4-D spray;[1] vines uncut	1½ lbs. to 125 gals.	95 gals.	10.1	630	20.0
9. 2,4-D spray;[1] vines cut 1 day after spraying	1½ lbs. to 125 gals.	95 gals.	4.8	564	7.8
10. 2,4-D spray;[1] vines cut within 2 hrs. after spraying	1½ lbs. to 125 gals.	95 gals.	0.2	620	10.8
11. 2,4-D spray;[1] vines cut previous to spraying	1½ lbs. to 125 gals.	95 gals.	0.0	586	6.1
12. Check			0.0	533	8.1

[1] A commercial product said to contain 70 per cent of sodium 2,4-dichlorophenoxyacetate.

[2] A dust containing 15 per cent of methyl 2,4-dichlorophenoxyacetate.

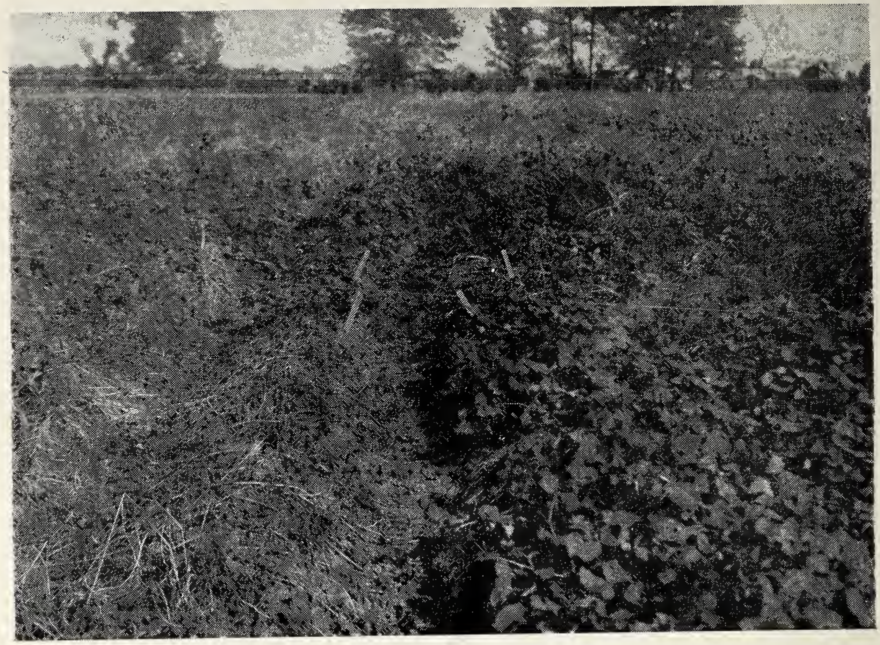

FIG. 3 — Sweet potato vines treated with herbicidal chemicals: Left foreground, with ammonium sulfamate; right foreground, check; left background, oil; right background, sodium fluoride.

These data indicate that relatively little of the 2,4-D was taken up by the stumps of the plants cut previous to, or soon after, the applications (treatments 11 and 10); but that enough had passed into the subterranean parts within 24 hours (treatment 9) to give almost maximum effect and within three days (treatment 6) total effect upon the roots.

The data presented in column 4 support the above observations regarding the rapidity of 2,4-D in penetrating the crowns. It was noted also that the potatoes in storage tended to sprout in the same order.

Workers in experiment stations over the country have found that traces of 2,4-D in the soil are highly injurious to young seedlings of practically all vegetables. The period required after treatment for planting with safety has not been determined, but 2,4-D may be expected to remain in the soil for at least four week. There were no ill effects apparent on weeds which grew on the soil following the 2,4-D treatments of the 1945 experiment, on sweet potatoes on the same soil in 1946, or on Austrian Winter peas following the 1946 experiment.

Two other materials, which were received too late to be included in the 1946 experiment, were tested on small areas of the same planting. These were lithium fluosilicate, which was applied both as a spray and as a dust, and a sodium arsenite solution (55 per cent As_2O_3) that was applied at dilutions of 1 to 100 and 1 to 200.

The lithium fluosilicate was about the same as calcium fluosilicate in effectiveness in killing the vines, the dust being a little superior to the spray. The sodium arsenite spray, 1 to 100 dilution, was extremely effective. It killed all vines and crowns to the surface of the ground. The 1 to 200 dilution was slightly less effective, but it gave what would be considered a satisfactory kill. A few potatoes, which were evidently exposed through cracks in the soil, appeared to be "burned" by the arsenical treatments.

Summary

Several chemicals were tested as herbicides against wild morning-glories and sweet potatoes, hosts of the sweet potato weevil, *Cylas formicarius elegantulus* (Sum.), in several series of experiments conducted at Opelousas, Louisiana, during 1944 and at Baton Rouge, Louisiana, during 1945 and 1946.

Sodium fluoride and calcium fluosilicate applied as dusts killed the vines of sweet potatoes and morning-glories to about the ground level. Sodium fluoride killed a considerable number of the crowns and roots of young plants of sweet potatoes and the morning-glories *Ipomoea hederacea* and *I. trichocarpa,* whereas calcium fluosilicate killed relatively few. Neither of these chemicals appeared to have any effect on the tuberous roots of *I. pandurata.* 2,4-D killed all the tops and roots of the morning-glories on which it was tested, except the large, tuberous roots of *I. pandurata,* which were largely, but not completely, destroyed; and all of the plants and nearly all of the old seed potatoes in "mother" rows.

In the experiments on sweet potatoes, dinitro-o-sec-butyl phenol, ammonium sulfamate, calcium fluosilicate, sodium pentachlorophenate, and sodium fluoride killed a high percentage of the vines down to the crowns, whereas the ammonium salt of dinitro-o-sec-butyl phenol was less effective; and superphosphate, applied at harvesttime, had no apparent effect on the decaying of the vines after they were plowed under. None of these chemicals appeared to have much, if any, effect on the potatoes.

In killing the vines and roots of sweet potatoes, 2,4-D was highly effective. It was relatively ineffective on the roots, however, when the crowns of the plants were cut before or within two hours after the application; maximum pentration appeared to occur within three days. The acid form, 2,4-dichlorophenoxyacetic acid, appeared to be slightly more effective than the sodium and methyl ester salts.

In limited tests lithium fluosilicate appeared comparable to calcium fluosilicate, and sodium arsenite solutions were highly effective in killing sweet potato vines.

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HELMINTHOSPORIUM BLIGHT OF OATS IN LOUISIANA

By

E. R. Stamper, John G. Atkins, Jr.
and John P. Gray

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Helminthosporium Blight of Oats in Louisiana

E. R. Stamper, John G. Atkins, Jr., and John P. Gray

The disease of oats known as *Helminthosporium* blight is one of the most destructive of the diseases which have become established in the United States in recent years. Susceptible varieties, when attacked, are so severely injured that a crop is often a total loss. As far as is known, susceptibility is confined to one group of varieties, the Victoria hybrids. These varieties have been among the more promising ones recently released by the U.S. Department of Agriculture and have been widely planted.

Since 1945 when the disease was first observed in Iowa, it has spread through the oat growing areas wherever the Victoria hybrids have been grown. It was first found in Louisiana in January, 1947, in a field of oats planted with seed from Arkansas. Later in the same year severe infection was found in several other fields. Because of the severity of the disease in these fields and its potential possibilities, a warning was issued by C. W. Edgerton of the Louisiana Agricultural Experiment Station which included the recommendation that other varieties be substituted for the susceptible Victoria hybrids. This recommendation was generally followed, and the acreage planted in susceptible varieties in the fall of 1947 was much reduced. It has been estimated that this saved the growers in Louisiana as much as $100,000.

During the crop year of 1947-48, experimental work was carried on to determine the susceptibility of the varieties likely to be grown in Louisiana and to determine the value of seed treatment as a measure to reduce losses in susceptible varieties. A survey was also made to determine the distribution of the disease in Louisiana. This bulletin summarizes the information obtained and gives the symptoms of the disease and recommendations as to varieties to be grown in Louisiana.

Symptoms of Helminthosporium Blight

While oat plants are affected by *Helminthosporium* blight at all stages of growth, symptoms and injury are more easily recognized on the seedlings and on older plants at time of heading.

The leaves of infected seedlings show yellow to orange stripes along the margin (Figure 1*A*). As these leaves develop, they become brownish to orange and finally die. The young plants may continue to grow, or if severely diseased, will die, resulting in a seedling blight and poor stands. Roots of diseased seedlings are often discolored and rotten (Figure 2). Infected plants usually lack vigor and grow poorly.

When the seed are germinated in a petri dish, the seedlings of

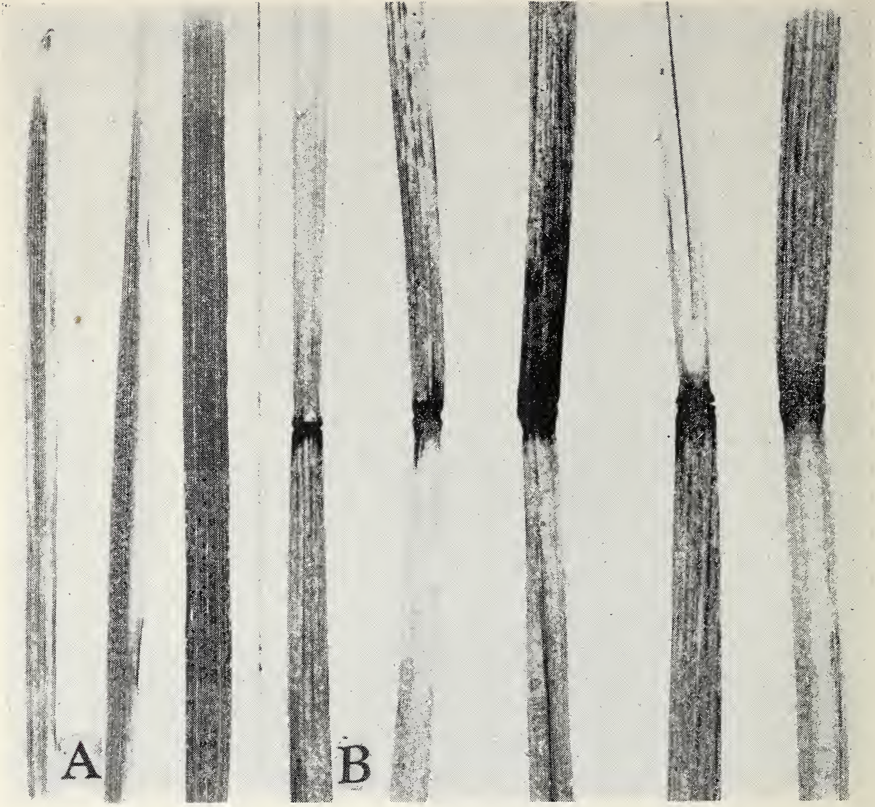

Fig. 1.—Symptoms of *Helminthosporium* blight of oats. *A*. Two leaves on left show striping in comparison with healthy leaf on right. *B*. Blackening of nodes of mature plants infected with the disease.

a susceptible variety deteriorate very rapidly. The susceptibility of a variety can usually be determined quickly by germinating the seed in this way (Figure 3).

When stooling begins, the diseased plants may be found singly or in small groups. As they reach the heading stage, there is a rotting of the crown and roots, accompanied by a browning of the lower internodes and a blackening of the nodes (Figure 1*B*). Infected plants are easily pulled up because of the poor root development. Considerable lodging may occur on account of bending or breaking of the stems. The blackening of the nodes is the most important symptom to use in the field of diagnosis of *Helminthosporium* blight. Later, at maturity, the grains also become black (Figure 4*A*).

It was noticed that at maturity, leaf spots often occurred which were distinct from the yellowish-orange striping of the leaves on seedlings. These were oval to elongate, and gray to brown. Typical

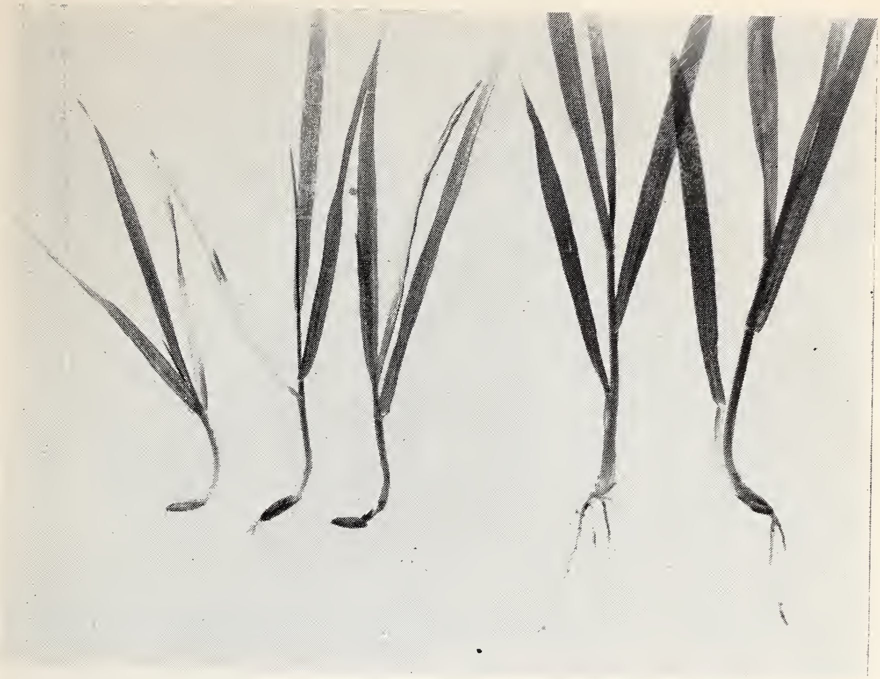

FIG. 2.—Root rot and dwarfing of oat seedlings infected with *Helminthosporium victoriae* (left) in comparison with healthy plants (right).

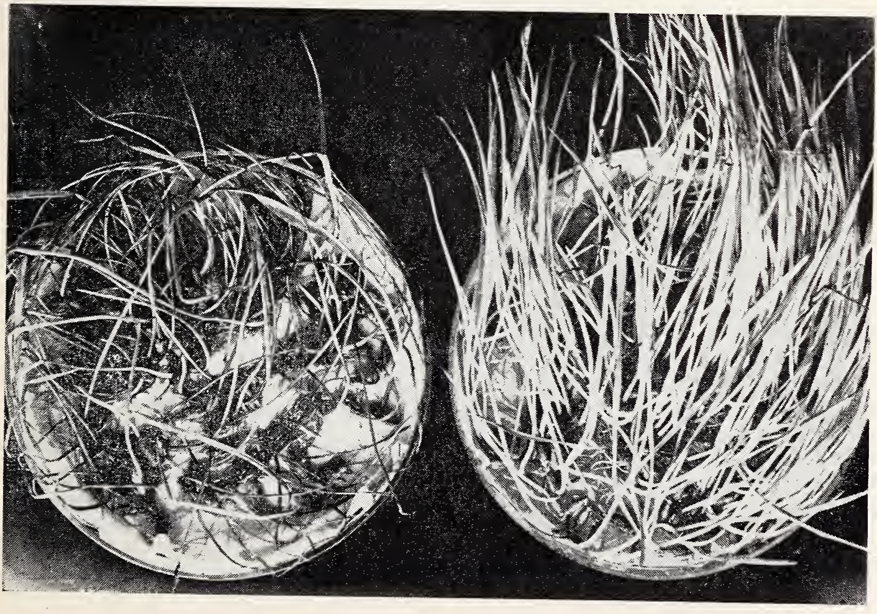

FIG. 3.—Reaction of a susceptible (Victorgrain) and a resistant variety (Nortex) to *Helminthosporium victoriae* in petri dishes.

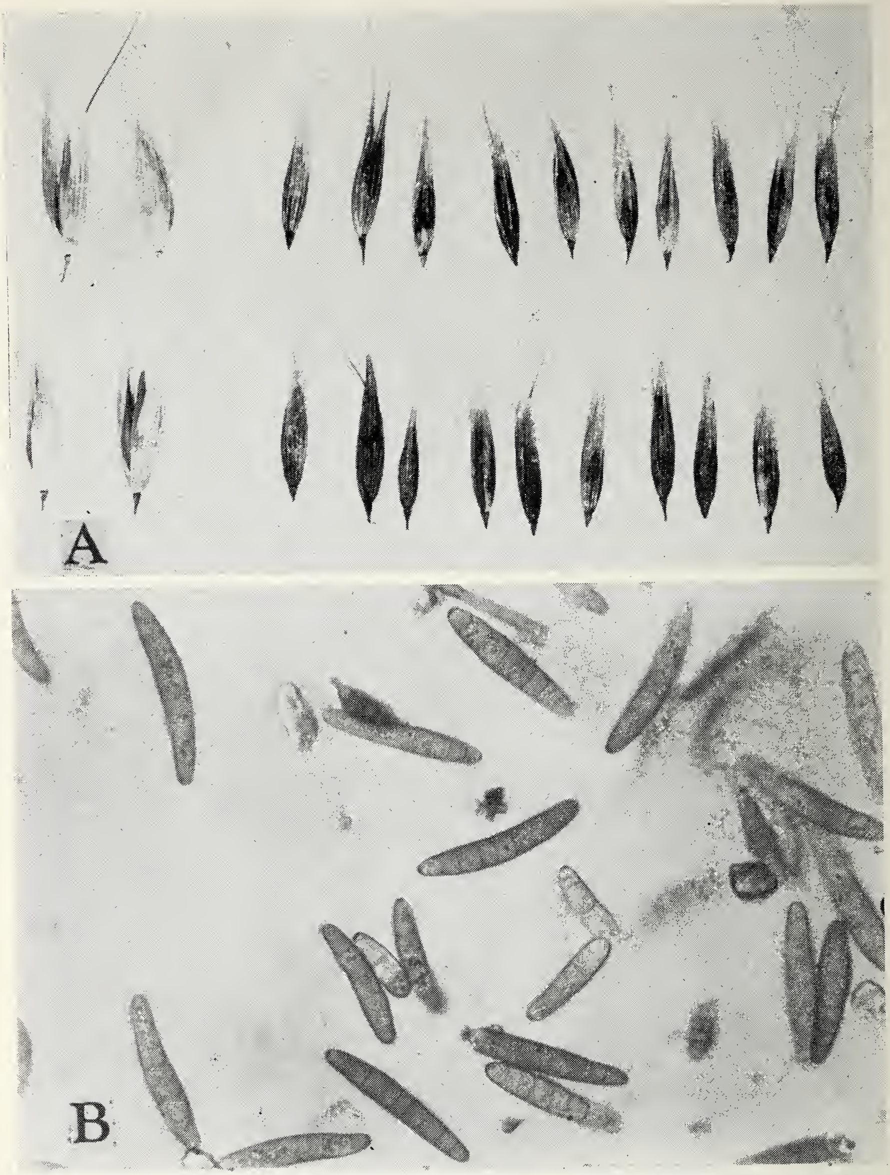

Fig. 4.—*A*. On right, oat seed of a susceptible variety blackened by *Helminthosporium victoriae*. Healthy seed of resistant variety on left. *B*. Spores of *Helminthosporium victoriae* (enlarged about 400 times).

spots varied in size up to 1/3 inch in length. The margins of the spots were usually distinct but were sometimes rather indefinite. The spots were larger on varieties with broad leaves, and when numerous often killed large areas of the leaves. Minute black bodies, the fruiting structures of the fungus, could be seen at times in the center of the large spots. The leaves often bent or broke at the point of leaf spot infection when the spots were large and located on the lower half of the leaf.

Cause of Helminthosporium Blight

The disease is caused by the fungus *Helminthosporium victoriae*, which was first described by Meehan and Murphy in Iowa. The fungus is seed-borne, occurring on the glumes of the oat seed. It apparently can live over from one year to the next in the soil, since once a field is infested, the disease appears when the field is planted with disease free seed.

The blackened nodes characteristic of the disease are due to the presence of the spores and conidiophores of the fungus. The spread of the disease in the field from diseased to healthy plants and from one field to a neighboring one is by means of these spores (Figure 4*B*), which are carried by the wind.

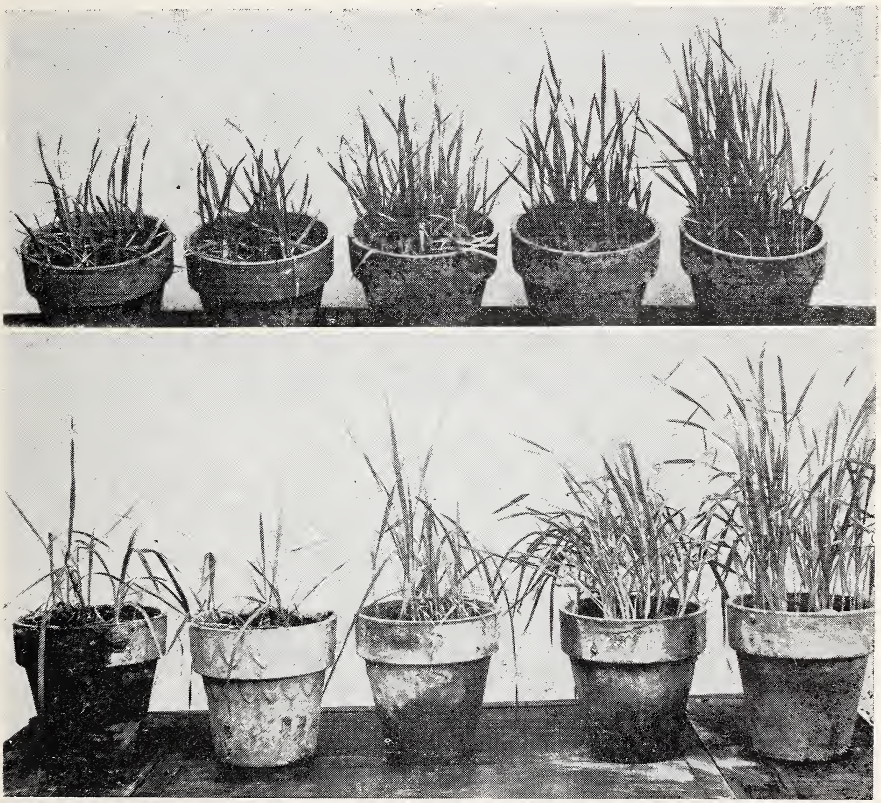

Fig. 5.—Reaction of oat varieties to *Helminthosporium* blight. Upper picture (left to right): Traveler, Victorgrain, Fulghum, Clinton, and Camellia. Lower picture (left to right): Traveler, Victorgrain, Fulgrain, Camellia, and Nortex.

Varietal Reaction

The oat varieties available at the present time for planting in Louisiana belong to three groups: Victoria hybrids, Bond hybrids, and Red Rustproof selections. The Victoria hybrids have been of particular value, since they have been very resistant to crown rust and stem rust, two diseases of considerable importance in Louisiana. They have as one of the original parents, the variety Victoria, and the resistance to the two rusts comes from this parent. The Bond hybrids are selections from crosses in which the variety Bond was used as one parent. Some of these varieties, of which Camellia is an example, are resistant to most races of crown rust but are susceptible to stem rust. The Red Rustproof selections are not as resistant to crown rust as the varieties belonging to the other two groups.

In order to have definite information on the resistance of the varieties likely to be grown in Louisiana to *Helminthosporium* blight, a number of greenhouse tests and one field test were made in the crop season of 1947-48.

In the greenhouse tests, the procedure used was the following. Pure cultures of the fungus from Iowa, New York and Louisiana were grown on sterilized oats until there was good growth and many spores. A suspension of spores and mycelium in water was made with a Waring blendor, and this was diluted 1 part to 9 of water. This was sprinkled over the seed and soil at planting and again as the seedlings emerged. The plants were grown in six-inch pots filled with Lintonia soil to which a small amount of fertilizer had been added. In the tests, 5 pots with 25 seeds to each pot were used for each variety. Two disease readings were made at 10-day intervals after the disease symptoms appeared. The temperature of the greenhouse was kept at approximately 72°F. The reaction of some of the varieties tested is shown in Figure 5.

The results of two greenhouse tests are given in Table 1. This table includes 23 varieties, one unnamed selection, and three seed lots of one variety, Victorgrain. The percentage of plants infected ranged from 0 to nearly 90, depending on the variety.

All of the eleven Victoria hybrids shown in the table were very susceptible. These included DeSoto, Fulgrain, Fultex, Lega, Letoria, Quincy Red, Ranger, Stanton, Traveler, Vicland and Victorgrain. The three Bond hybrid varieties and one unnamed selection, Benton, Camellia, Clinton and Louisiana 42-48, were all resistant. Eight of the nine Red Rustproof varieties were very resistant. These were Alber, Appler, Ferguson 922, Fulghum, Hasting's 100 Bu., Louisiana Red Rustproof, Lee, New Nortex and Nortex 107. Fulghum was intermediate. This erratic reaction of Fulghum also has been found in other areas.

TABLE 1. Reaction of Oat Varieties to *Helminthosporium Victoriae* in Greenhouse Tests in 1947-48

Variety	Per Cent Infected Plants		
	Test 1	Test 2	Average
VICTORIA HYBRIDS			
DeSoto	57.4	44.2	50.8
Fulgrain	43.2	23.3	33.3
Fultex	56.2	59.3	57.8
Lega	48.7	88.6	68.7
Letoria	39.4	55.4	47.4
Quincy Red	48.0	38.7	43.4
Ranger	17.6	50.4	34.0
Stanton	45.7	38.2	42.0
Traveler	65.5	54.5	60.0
Vicland	45.2	57.3	51.3
Victorgrain (Lot 1)	49.6	78.7	64.2
Victorgrain (Lot 2)	69.2	65.0	67.1
Victorgrain (Lot 3)	56.8	79.2	68.0
BOND HYBRIDS			
Benton	0.9	8.5	4.7
Camellia	0.0	5.9	3.0
Clinton	0.0	4.6	2.3
La. 42-48*	5.6	20.7	13.2
RED RUSTPROOF VARIETIES			
Alber	0.0	4.7	2.4
Appler	0.8	0.9	0.9
Ferguson 922	0.8	0.0	0.4
Fulghum	32.8	27.9	30.4
Hasting's 100 Bu.	0.0	1.8	0.9
La. Red Rustproof	3.2	0.0	1.6
Lee	7.1	4.5	5.8
New Nortex	0.0	3.3	1.7
Nortex 107	0.0	0.0	0.0

*A promising selection similar to Camellia which has not yet been released.

In addition to the named varieties of oats given in Table 1, a number of selections were also tested in the greenhouse. These were provided by the Coker's Pedigreed Seed Company and the Crops and Soils Department of the Louisiana Agricultural Experiment Station. Data for a few of these unnamed selections are given in Table 2 to illustrate the necessity of testing promising selections before they are released as named varieties or before they are used in extensive yield tests.

TABLE 2. Results of Inoculation Tests with Unnamed Selections of Oats for Resistance to *Helminthosporium* Blight

Selection Number	Source	Per Cent Infection		
		Test 1	Test 2	Average
Coker 47-77	Coker's Seed Co.	0.0	0.0	0.0
Coker 47-78	Coker's Seed Co.	0.0	0.0	0.0
Coker 47-51	Coker's Seed Co.	67.0	68.3	67.7
Coker 47-52	Coker's Seed Co.	43.1	75.0	59.1
II-49	Crops and Soils, L. S. U.	0.0	0.0	0.0
II-50	Crops and Soils, L. S. U.	0.0	0.0	0.0
II-16	Crops and Soils, L. S. U.	75.6	75.4	75.5
II-20	Crops and Soils, L. S. U.	73.4	79.2	76.3

One field test was made in the fall of 1947. Seeds of the twelve varieties used were sprayed with a spore suspension of *Helminthosporium victoriae* and dried. They were planted on November 6, and disease readings were made December 16.

The tests, Table 3, while showing less diseased plants than the greenhouse tests, gave essentially the same results. The four Victoria hybrids, Letoria, Quincy Red, Traveler and Victorgrain, were susceptible; the three Bond hybrids, Camellia, Clinton and Louisiana 42-48, and of the five Red Rustproof varieties, Alber, Ferguson 922, Fulghum, and Nortex 107 were resistant. Appler was intermediate in this test, but symptoms were much less severe.

TABLE 3. Reaction of 12 Oat Varieties to *Helminthosporium victoriae* in Field Test in 1947-48

Victoria Hybrids		Bond Hybrids		Red Rustproof	
Variety	% Infected Plants	Variety	% Infected Plants	Variety	% Infected Plants
Letoria	27.7	Camellia	9.2	Alber	5.3
Quincy Red	32.7	Clinton	3.2	Appler	17.3
Traveler	26.0	La. 42-48	4.0	Ferguson 922	4.3
Victorgrain	35.5			Fulghum	2.3
				Nortex 107	1.8

Occurrence of Helminthosporium Blight in Louisiana in 1948

A survey was made to determine the damage caused by *Helminthosporium victoriae* in Louisiana in the 1947-48 oat crop. The oat-growing sections of Louisiana, including Northeastern, Northwestern, Central, and Southern, were visited in the survey.

Most of the oats planted in these sections were either Bond or Red Rustproof varieties. In former years before the *Helminthosporium* blight became a factor, the plantings of the Victoria hybrids, Fulgrain, Fultex, Victorgrain, Traveler, and other early maturing varieties had been unusually large. Camellia oats were planted almost exclusively in the Baton Rouge area.

Results shown in Table 4 indicate the amount of the disease and its severity on the Victoria hybrids. It was impossible to be certain as to the identity of varieties in some fields grown for feed and pasture. The seed used was evidently not pure and mixtures were present in many fields.

TABLE 4. Survey to Determine the Occurrence of *Helminthosporium* Blight in Louisiana in 1948, Based on Leaf and Culm Symptoms

Variety	Maturity	Acreage	Leaves	Culms	Location
Victoria Hybrid[*]	Late Dough	30	5[†]	5[†]	Tensas
Victoria Hybrid	Late Dough	30	5	1	Madison
Victoria Hybrid	Late Dough	12	5	3	Madison
Mixed Victoria Hybrid	Late Dough	25	5	1	Franklin
Mixed Victoria Hybrid	Late Dough	35	5	0	Franklin
Victorgrain	Late Dough	25	5	1	Franklin
Victorgrain	Dough	40	5	2	Catahoula
Victorgrain	Late Dough	40	5	1	Franklin
Victorgrain	Late Dough	27	5	2	Catahoula
Victorgrain	Late Dough	60	5	5	Caddo
Victorgrain	Late Dough	20	5	2	Caddo
Victorgrain	Late Dough	50	Complete	Loss	Caddo
Victorgrain	Late Dough	100	5	3	Bossier
Victoria Hybrid	Late Dough	45	5	2	Bossier
Fulghum	Late Dough	100	3	0	Caddo
Mixed Victoria	Late Dough	60	5	1	Caddo
Victoria Hybrid	Late Dough	40	5	2	Ouachita
Victoria Hybrid	Late Dough	100	5	1	Ouachita
Letoria	Late Dough	55	5	1	Ouachita
Victoria Hybrid	Late Dough	30	5	1	Morehouse
Fulgrain	Late Dough	80	5	2	Ouachita
Traveler	Dough	25	4	0	Ouachita
Victoria Hybrid	Late Dough	18	5	2	Ouachita
Camellia	Various	3000	0	0	Baton Rouge
Nortex	Milk	600	0	0	Ouachita

[*] Victoria hybrid: Name of variety not known.

[†] Key to symbols indicating severity of disease on leaves and culms: 1–Trace; 2–Disease easily found; 3–Prevalent; 4–Prevalent and culms breaking at nodes; 5–Disease severe.

There was very little difference in the degree of infection on the leaves, although there was some difference in degree of infection on the culms. Some fields of Victoria hybrids were so severely damaged they were not harvested.

As indicated in Table 4, *Helminthosporium* blight was not found on any of the Red Rustproof or Bond varieties in the field except Fulghum. On Fulghum the disease was found on the leaves and not on the culms.

Seed Treatment

As seed treatment with New Improved Ceresan has been recommended in other areas for varieties susceptible to *Helminthosporium* blight, tests were made to determine if such treatment would have value under Louisiana conditions. Two fungicides, New Improved Ceresan and Dow 9B, were used in tests at Baton Rouge and at the Northeast Louisiana Agricultural Experiment Station, St. Joseph. Victorgrain and Camellia were the varieties used. The seed were treated one week before planting for the test at Baton Rouge and five weeks before planting for the one at St. Joseph. The chemicals were shaken with the seed and the excess screened off. More of the chemicals than is generally recommended were used. Five replications, each consisting of 20 feet of row with the same number of seed, were used for each variety at each place.

The results, given in Table 5, show that New Improved Ceresan was very toxic. Dow 9B gave no increases in stand. No differences in the amount of *Helminthosporium* blight were noted.

TABLE 5. Results of Seed Treatment Tests with Two Oat Varieties at Baton Rouge and St. Joseph, Louisiana, in the Fall of 1947

Variety	Baton Rouge			St. Joseph		
	No Treatment	New Improved Ceresan	Dow 9B	No Treatment	New Improved Ceresan	Dow 9B
	Per Cent Emergence					
Victorgrain	73.8	11.1	80.8	75.0	0.1	69.1
Camellia	87.5	42.3	95.0	88.5	25.7	89.7

Another test was made at Baton Rouge with six chemicals. Only the variety Victorgrain was used. The percentage emergence is given in Table 6. Both the New Improved Ceresan and Ceresan M were toxic. None of the chemicals increased stands or reduced *Helminthosporium* blight.

One other test was made in the greenhouse in soil infested with *Helminthosporium victoriae* and in clean soil. New Improved Ceresan at ½ oz., 1 oz., and 1½ oz. to the bushel was used with naturally infected seed of the oat variety Victorgrain. The results (Table 7) indicate seed treatment was of little value in increasing stands or reducing the number of infected seedlings.

During the season, several fields were examined which had been planted with seed treated with New Improved Ceresan. There was as much disease present as in fields planted with untreated seed.

The results of the tests did indicate that an excessive amount of Ceresan should not be used, not over ½ to 1 oz. to the bushel.

TABLE 6. Results of Seed Treatment Tests with Six Fungicides on Victorgrain Oats

Treatment	Average Number Plants Emerged*	Percentage Emergence
Ceresan M	21	10.5
N. I. Ceresan	2	1.0
Phygon	127	63.5
Spergon	132	66.0
Dow 9B	145	72.5
Arasan	156	78.0
Untreated	150	75.0

*Average of five replications, 200 seed per replication. Planted November 25, 1947. Stand counts made December 16, 1947.

TABLE 7. Effect of Different Rates of New Improved Ceresan on Naturally Infected Victorgrain Oats in Greenhouse Test

Rate Per Bushel	Infested Soil		Non-Infested Soil	
	Percentage Emergence	Percentage Infection	Percentage Emergence	Percentage Infection
½ Ounce + Talc	97.6	75.2	97.6	44.3
½ Ounce	94.5	59.3	87.2	20.1
1 Ounce	91.2	67.5	87.2	31.1
1½ Ounces	71.2	73.0	79.2	11.1
Untreated	84.8	82.1	87.2	16.6

Discussion

The results of the tests to determine susceptibility of the varieties of oats to *Helminthosporium victoriae* indicate that none of the Victoria hybrids which have been released are safe for planting in Louisiana. This means that the varieties to be grown in Louisiana, for the present at least, will of necessity be those from Bond crosses and Red Rustproof types. While the shift from the Victoria hybrids to these other varieties will eliminate losses due to *Helminthosporium* blight, it is an unfortunate change, since losses from crown rust and stem rust may occur, particularly in years which are favorable for the development of rust epidemics.

It is hoped that new varieties will eventually be produced that will have the rust resistance that made the Victoria hybrids so valuable, as well as the resistance to the *Helminthosporium* blight.

Summary

The *Helminthosporium* blight of oats caused by *Helminthosporium victoriae* is described in this bulletin.

The resistance and susceptibility of 24 oat varieties has been determined.

Varieties selected from crosses in which Victoria was one parent were susceptible to the disease. Varieties selected from crosses in which Bond and not Victoria was one parent or from the Red Rustproof group were resistant. On account of the severe loss caused by the *Helminthosporium* blight, it apparently will not be possible to grow susceptible Victoria hybrids in Louisiana.

Seed treatment tests showed little or no promise in controlling the disease with susceptible varieties.

Recommendations

1. The Victoria hybrids, such as Victorgrain, Traveler, Fulgrain and Letoria, are so susceptible to *Helminthosporium* blight that they should not be planted in Louisiana. Seed treatments have not prevented losses and at present are not being recommended.
2. The Camellia variety is resistant and is recommended for further planting in certain sections of the state, particularly in the Southern and Central sections.
3. In the Northern part of the state, growers should at present select their varieties for planting from among the Red Rustproof group, such as New Nortex, Nortex 107, and Hasting's 100 Bushel.
4. New varieties that come out in the future should be tested by the Louisiana Agricultural Experiment Station for resistance to *Helminthosporium* blight and should not be planted on a large scale by growers before being recommended by the station.

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LOUISIANA BULLETIN NO. 432 OCTOBER 1948

RELATIONSHIP OF CLIMATE AND GIN MACHINERY TO ROUGH GIN PREPARATION OF COTTON IN LOUISIANA

By

JAMES F. HUDSON

TECHNOLOGY AND [illegible] BRANCH

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TABLE OF CONTENTS

Page

Introduction 5

Source and Nature of Data 5

Extent of Rough Preparation 7

Weather in Relation to Rough Preparation 9

Gin Machinery and Operation in Relation to Rough Preparation 17

Rough Preparation May Be Reduced 23

Summary and Conclusions 24

LIST OF TABLES

Table

1 The Percentage of Rough Preparation, by States, South Central Area, 1933-46.......... 7

2 The Proportion of Cotton Reduced in Grade Due to Rough Preparation, Louisiana, 1942, 1943 and 1944.......... 10

3 The Proportion of Cotton of Different Staple Lengths Reduced in Grade Due to Rough Preparation, Louisiana, 1942-1944 11

4 The Proportional Reduction in Grade Due to Rough Preparation in Relation to the Rainfall and the Number of Rainy Days, by Months, Louisiana, 1942-1944.......... 13

5 Proportional Reduction in Grade, Amount of Rainfall and Number of Rainy Days During the Cotton Harvesting Season, by Districts, Louisiana, 3-Year Average, 1942-1944.... 14

6 The Proportional Reduction in Grade Due to Rough Preparation in Relation to the Rainfall and the Number of Rainy Days, by Months, by Districts, Louisiana, 1942-1944 15

7 Influence of Seed-Roll Density on Rough Preparation of Cotton, by Districts, Louisiana, 1946.......... 19

8 Influence of Driers on Rough Preparation of Cotton, by Districts, Louisiana, 1946.......... 20

9 Influence of Saw Speed on Rough Preparation of Cotton, by Districts, Louisiana, 1946.......... 20

10 Influence of Cleaning Equipment on Rough Preparation of Cotton, by Districts, Louisiana, 1946.......... 21

11 Relationship of Type of Feeder to Rough Preparation of Cotton, by Districts, Louisiana, 1946.......... 21

LIST OF FIGURES

Figure

1 Cotton Grade and Staple Reporting Districts, Louisiana, 1947 6

2 The Proportion of Upland Cotton Reduced One or More Grades Because of Rough Preparation, by States, 5-year Average, 1940-44 8

3 Relation Between Per Cent of Cotton Reduced Because of Rough Preparation and Average Monthly Rainfall, by Districts, August-December, 1942-44 16

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Relationship of Climate and Gin Machinery to Rough Gin Preparation of Cotton in Louisiana

By James F. Hudson

Introduction

During recent years the percentage of rough preparation in Louisiana has increased. Financial loss on the 1944-45 crop due to rough preparation is estimated to have averaged approximately $1.75 per bale, or around one million dollars. Rough cotton is undesirable in the manufacture of many cotton products, and the increase in rough preparation has resulted in the loss of outlets for Louisiana cotton. Any reduction in the amount of rough preparation would increase the spinning utility of the lint and add considerably to its value. The purposes of this study are to determine the extent of rough preparation, its seasonal and annual distribution in relation to rainfall and other weather conditions, and its relationship to gin equipment and the operation of gins in Louisiana.

The grade of cotton lint is determined by its preparation, color, and foreign matter, all of which contribute to its spinning utility. Preparation denotes the degree of smoothness of the ginned lint, its relative nappiness or neppiness. If ginned properly, cotton has a smooth, even appearance; whereas, rough cotton is characterized principally by the presence of rather large, more or less tightly-matted masses of fiber in the sample. Rough preparation may lower the grade of cotton one or more grades, depending upon the extent of roughness. Cotton reduced more than two grades is considered "Gin Cut." There is a direct relationship between the moisture content of seed cotton when ginned and the preparation or degree of smoothness of the ginned lint. The equipment used in the gin, its condition and operation are related directly to the extent of rough preparation.

Tentative standards for preparation of cotton with a staple length of one and one-eighth inches and longer have been established for Strict Middling, Middling and Strict Low Middling grades. For the shorter lengths the factor of preparation is shown in the boxes for each White grade and the classers give their concept of the degree of roughness. A sample of cotton matching the Middling standard in color and foreign matter and having rougher than normal preparation for that grade is considered rough and reduced in grade.

Source and Nature of Data

Data relating to the grade, staple length and preparation of cotton were obtained from the officer in charge of the Government Cotton Classing Offices located in Alexandria and in New

Orleans, Louisiana. The samples of cotton used were those gathered by the Cotton Branch from ginners for use in the Cotton Quality Reports. The climatological data for Louisiana were obtained from monthly publications of the United States Department of Commerce, Weather Bureau. Gin equipment data were obtained in cooperation with the United States Department of Agriculture Cotton Ginning Laboratory located in Stoneville, Mississippi.

A total of 53,406 cotton samples in 1942; 53,385 in 1943; 60,034 in 1944; and 23,218 in 1946 were tabulated for analysis. The samples used represented cotton ginned at 46 gins in 1942, 46 gins in 1943, 65 in 1944 and 39 in 1946. Gins submitting samples and equipment data had been selected by the Cotton Branch as being representative of those located in each area of the state.

The climatological data were obtained for the five-month period of August through December, which is comprehensive, since 99 per cent of the cotton in the state is normally ginned during this

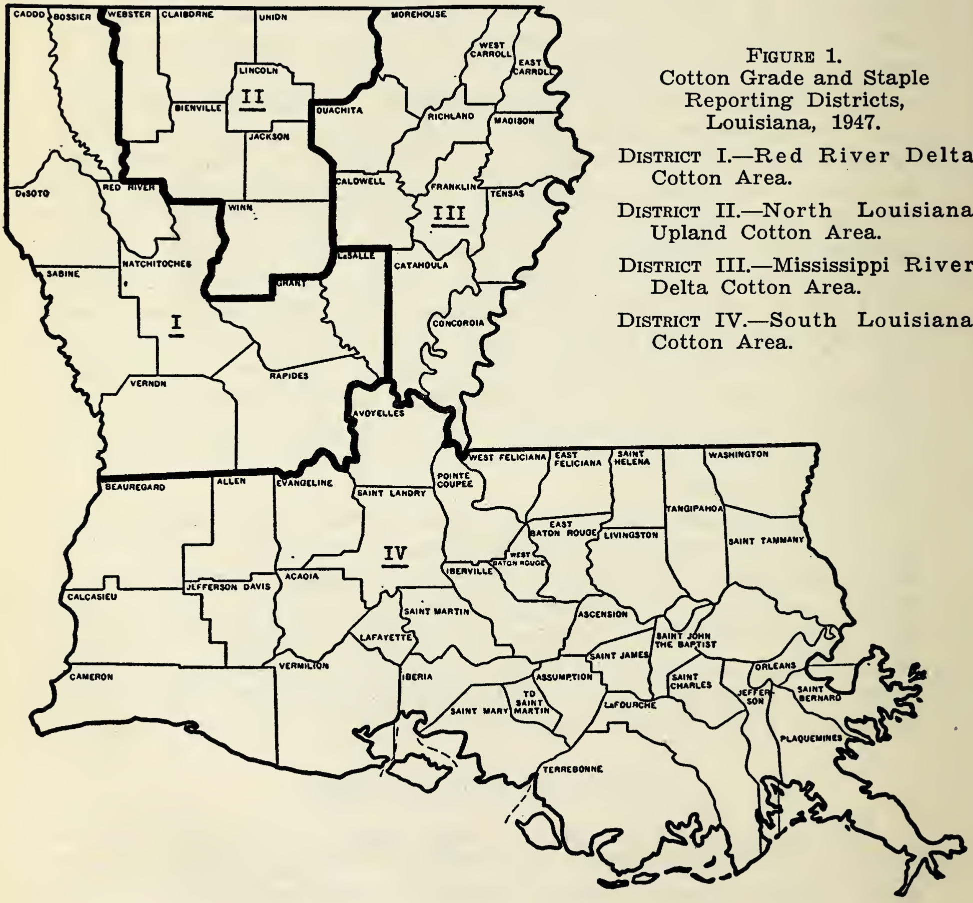

FIGURE 1.
Cotton Grade and Staple Reporting Districts, Louisiana, 1947.

DISTRICT I.—Red River Delta Cotton Area.

DISTRICT II.—North Louisiana Upland Cotton Area.

DISTRICT III.—Mississippi River Delta Cotton Area.

DISTRICT IV.—South Louisiana Cotton Area.

period. Climatological data were obtained from the weather stations located in the same vicinities as the gins used in the study.

The state is divided into four Cotton Grade and Staple Reporting Districts as set up by the Cotton Branch for use in its Quality Statistics Program. These districts broadly represent the four cotton-producing areas of the state: District I, the Red River Delta Cotton Area; District II, the North Louisiana Upland Cotton Area; District III, the Mississippi River Delta Cotton Area; and District IV, the South Louisiana Cotton Area (Figure 1).

Extent of Rough Preparation

In each of the seasons considered, with the exception of 1933 and 1945, Louisiana had a higher percentage of the cotton crop reduced in grade than any other state in the South Central Area (Table 1).

During the period from 1933 through 1939 the percentage of rough preparation in the area states was relatively small; however, since 1939 the percentage of rough preparation has increased materially.

The average percentage of upland cotton reduced in grade because of rough preparation in 14 major cotton-producing states is shown in Figure 2. Florida ranked highest with 26.8 per cent; Virginia second, with 21.8 per cent, and Louisiana third, with 19.9

TABLE 1. THE PERCENTAGE OF ROUGH PREPARATION, BY STATES, SOUTH CENTRAL AREA, 1933-46

Year	Percentage of rough preparation				
	Louisiana	Arkansas	Mississippi	Missouri	Tennessee
	%	%	%	%	%
1933	10.7	8.7	10.9	10.7	6.2
1934	8.3	2.0	3.2	3.0	1.3
1935	12.9	5.2	5.9	10.3	5.7
1936	3.7	1.1	1.1	1.3	0.9
1937	5.6	3.4	3.9	2.6	4.6
1938	5.0	1.3	2.8	2.2	3.2
1939	7.0	1.5	2.9	1.9	4.1
1940	21.8	6.0	8.6	4.1	11.0
1941	30.4	6.3	11.5	2.5	5.5
1942	22.5	3.3	7.9	2.6	3.1
1943	8.9	2.3	4.6	0.3	7.6
1944	23.4	6.6	9.8	1.1	7.3
1945	8.7	8.7	7.3	4.6	13.7
1946*	12.4	11.2	9.1	12.3	9.9

*Preliminary.

Source: Compiled from "Cotton Quality Reports," U.S.D.A., Cotton Branch.

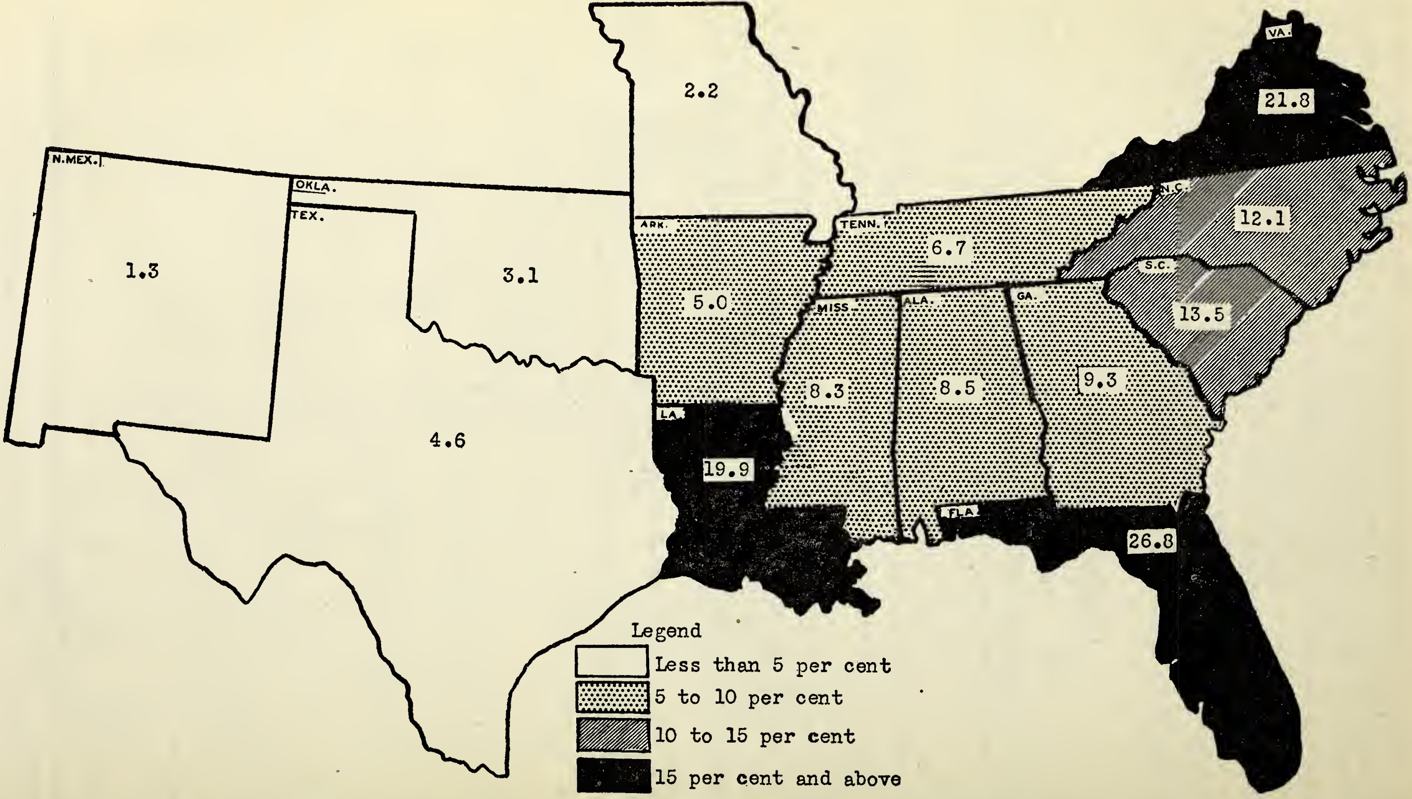

FIGURE 2.—The Proportion of Upland Cotton Reduced One or More Grades Because of Rough Preparation, by States, 5-Year Average, 1940-44.

per cent. The coastal cotton-producing states have a relatively higher percentage of cotton reduced in grade than do the interior cotton states.

The largest percentage of cotton in the state reduced one or more grades because of rough preparation appears in the South Louisiana Cotton Area, District IV. The second largest percentage of grade reduction occurs in the North Louisiana Upland Cotton Area, District II. The Red River Delta Cotton Area and the Mississippi River Delta Cotton Area, Districts I and III, respectively, have the smallest proportion of cotton reduced in grade. There is very little difference in the amount of rough preparation in Districts I and III. Although District II has the second largest percentage of cotton reduced one grade, it has the smallest percentage reduced two or more grades (Table 2).

A smaller percentage of short staple cotton is reduced in grade because of rough preparation as compared with cotton having a staple length of one and one-eighth inches and longer. District III has the smallest percentage of cotton with staple lengths of one and one-eighth inches and longer reduced in grade. For the state as a whole, one and one-eighth inches and longer staple cotton represents only about 3 per cent of the total crop. Districts I, II and IV have less than 1 per cent and District III has 8 per cent one and one-eighth inches and longer staple cotton. The large percentage of one and one-eighth inches and longer cotton reduced in grade in Districts I, II, and IV has very little effect on the percentage of the total crop reduced in grade (Table 3).

Weather in Relation to Rough Preparation

Cotton harvested early in the season or under adverse weather conditions, unless unusual care has been taken in picking and handling, contains a greater amount of immature cotton and has a higher moisture content than cotton harvested under favorable conditions. Weather conditions preceding and during the early part of the cotton season are reflected in the percentage of rough preparation of cotton ginned during the season. This is emphasized by a study of weather conditions since 1933 along with the amount of rough preparation during these years.

During 1933 excessive rainfall in July and the early part of August caused some damage to the cotton crop, but in general, conditions were favorable. During 1934 and 1935, conditions were favorable throughout the state with the exception of South Louisiana, where cotton was damaged somewhat by excessive rains during the early part of the season. From 1936 through 1939 weather conditions were very favorable during the harvesting season throughout the state. The percentage of rough preparation was somewhat higher during the period from 1933 to 1935 than it was from 1936 to 1939.

TABLE 2. THE PROPORTION OF COTTON REDUCED IN GRADE DUE TO ROUGH PREPARATION, LOUISIANA, 1942, 1943 AND 1944[1]

District	Reduced one grade			Reduced two grades			Gin cut			Total gin damage		
	1942	1943	1944	1942	1943	1944	1942	1943	1944	1942	1943	1944
	%	%	%	%	%	%	%	%	%	%	%	%
I. Red River Delta	15.4	3.1	12.8	1.1	0.1	0.4	0.1	0.0	*	16.6	3.2	13.2
II. North Louisiana Upland	17.6	6.1	25.2	0.5	*	0.3	*	0.0	0.0	18.1	6.1	25.5
III. Mississippi River Delta	14.8	4.6	5.2	1.3	0.1	0.0	0.1	0.0	0.0	16.2	4.7	18.1
IV. South Louisiana	35.5	17.4	34.5	4.6	2.3	1.7	0.9	0.2	*	41.0	19.9	36.2
Total	20.2	7.1	21.1	1.9	0.6	0.8	0.3	*	*	22.4	7.7	21.9

[1] For period August–December.

*Less than 0.05 per cent.

TABLE 3. The Proportion of Cotton of Different Staple Lengths Reduced in Grade Due to Rough Preparation, Louisiana, 1942-44

District	Reduced one grade			Reduced two grades			Gin cut			Total reduced in grade			Percentage of crop		
	1942	1943	1944	1942	1943	1944	1942	1943	1944	1942	1943	1944	1942	1943	1944
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Cotton shorter than 1 and 1/8 inches															
I. Red River Delta	15.3	3.0	12.8	1.0	0.1	0.4	0.1	0.0	*	16.4	3.1	13.2	99.1	99.1	99.8
II. North Louisiana Upland	17.6	6.1	25.2	0.5	*	0.2	*	0.0	0.0	18.1	6.1	25.4	100.0	99.5	99.7
III. Mississippi River Delta	14.5	4.3	16.9	1.2	0.1	0.5	0.1	0.0	*	15.8	4.4	17.4	94.4	91.9	90.9
IV. South Louisiana	35.5	17.3	34.5	4.6	2.3	1.7	0.9	0.2	*	41.0	19.8	36.2	99.9	99.6	99.9
Total	20.2	7.1	21.0	1.9	0.6	0.8	0.3	*	*	22.4	7.7	21.8	97.4	96.1	97.1
Cotton 1 and 1/8 inches and longer															
I. Red River Delta	36.1	7.2	3.4	6.5	0.7	0.0	0.0	0.0	0.0	42.6	7.9	3.4	0.9	0.9	0.2
II. North Louisiana Upland	100.0	4.5	33.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0	4.5	33.3	*	0.5	0.3
III. Mississippi River Delta	19.8	7.2	23.9	2.7	0.2	0.7	0.1	0.0	0.0	22.6	7.4	24.6	5.6	8.1	9.1
IV. South Louisiana	25.0	35.9	27.8	0.0	7.5	16.6	0.0	0.0	0.0	25.0	43.4	44.4	0.1	0.4	0.1
Total	21.2	7.9	23.7	2.9	0.4	0.9	0.1	0.0	0.0	24.2	8.3	24.6	2.6	3.9	2.9

*Less than 0.05 per cent,

Since 1939, with the exception of 1943 and 1945, Louisiana has experienced a series of very unfavorable crop years. Excessive rainfall during July, August, and September caused considerable damage to the cotton crop. Rainfall prevented the control of boll weevils and other insects, cotton growth was rank and sappy, fruiting slow and poor, and a considerable acreage of cotton had to be abandoned in the fields. During those years in which cotton was harvested under adverse conditions the percentage of rough preparation increased materially. The percentage of rough preparation during 1943 and 1945 was low owing to favorable weather conditions.

The largest percentage of monthly ginnings reduced one or more grades because of rough preparation and the greatest amount of rainfall in Louisiana occur during the months of August and September. In addition, a relatively large proportion of the cotton ginned during August and September is picked in a green, immature condition.

The proportion of monthly ginnings reduced one or more grades because of rough preparation is relatively small during the months of October and November. During this period there is less rainfall and a smaller portion of the crop is in a green, immature condition. Although the amount of rainfall increases considerably in December, the percentage of cotton reduced in grade does not show a comparable increase. By December the cotton harvest is near completion and the period of time between picking and ginning is usually longer, allowing more time for the cotton to dry out. As the season progresses, the grade of the cotton ginned tends to be somewhat lower and the cotton carries a greater amount of rough preparation without being reduced in grade.

Those months in which the largest proportion of cotton is reduced in grade also have the greatest number of rainy days (Table 4). The number of rainy days tends to increase the effect of rainfall on the preparation of the cotton ginned. A specified amount of rainfall over a number of days has a greater effect on the rough preparation of cotton than does an equal amount over a shorter period. Extended periods of rainfall leave less opportunity for the seed cotton to dry out in the field before being picked and delivered to the gin.

A given amount of rainfall does not have the same effect each year. However, a given amount of rainfall in August and September, although it may not have the same effect each year, will have more nearly the same effect than a like amount late in the season. Later in the season the cotton will dry out more quickly and less damage will occur from a given amount of rainfall because the foliage is not as heavy, the water content of the seed and plant is lower, and much of the cotton has been open for a longer period of time. The above is also true for a given number of rainy days.

Because of the high moisture content of green or immature

TABLE 4. The Proportional Reduction in Grade Due to Rough Preparation in Relation to the Rainfall and the Number of Rainy Days, by Months, Louisiana, 1942-1944

Month	1942				1943				1944			
	Crop ginned	Reduced grade	Rain-fall	Rainy days	Crop ginned	Reduced grade	Rain-fall	Rainy days	Crop ginned	Reduced grade	Rain-fall	Rainy days
	%	%	Inches	Days	%	%	Inches	Days	%	%	Inches	Days
August..........	11.2	61.9	6.15	13	29.2	9.5	2.92	5	9.1	35.4	7.08	13
September........	52.9	26.2	5.09	8	41.7	9.9	10.15	10	43.4	34.8	4.02	8
October..........	32.5	4.4	3.10	5	20.8	3.5	1.47	2	34.2	12.1	1.16	2
November........	3.4	5.8	1.17	4	6.6	1.8	3.79	4	10.3	8.3	7.88	9
December........	0.0	0.0	5.16	9	1.7	0.2	5.22	9	3.0	20.7	6.09	9
Total........	100.0	22.4	20.67	39	100.0	7.7	23.55	30	100.0	21.9	26.23	41

cotton, its effect upon the smoothness of gin preparation is similar to that of rainfall. Data were not available to distinguish between the amount of rough preparation resulting from the ginning of green or immature cotton and that resulting from ginning cotton of high moisture content due to rainfall.

The three-year average percentage of upland cotton reduced one or more grades because of rough preparation, by districts in Louisiana, is shown in Table 5. There was a considerably greater percentage of rough preparation in District IV than in any of the other three districts during this period. The average rainfall and number of rainy days were also considerably higher in District IV than in the other districts. District II had the second highest percentage of rough preparation, average rainfall and number of rainy days. District III had a higher percentage of rough preparation than did District I, slightly less rainfall, and a greater number of rainy days.

TABLE 5. PROPORTIONAL REDUCTION IN GRADE, AMOUNT OF RAINFALL AND NUMBER OF RAINY DAYS DURING THE COTTON HARVESTING SEASON,[1] BY DISTRICTS, LOUISIANA, 3-YEAR AVERAGE, 1942-1944

	District			
	I Red River Delta	II North Louisiana Upland	III Mississippi River Delta	IV South Louisiana
Proportional reduction in grade—per cent......	10.7	17.8	12.4	32.5
Average total rainfall—inches...............	17.82	18.60	17.67	26.03
Average total number of rainy days..........	32.9	35.4	33.4	37.7

[1] August through December.

District IV had the highest percentage of cotton ginned reduced one or more grades because of rough preparation in each of the three seasons, 1942-1944. The percentage reduced in District IV was almost double that in any of the other three districts. District I had the smallest percentage of rough cotton during each season with the exception of 1942. District III had the smallest percentage of rough cotton during 1942, but had slightly more than District I during 1943 and 1944. The total rainfall and number of rainy days were relatively high in District IV as compared with the other three districts (Table 6). A greater percentage of the total crop in District IV was ginned during August and September than in the other districts.

The relationship between average monthly rainfall and percentage of rough preparation, by districts, is shown in Figure 3. With an equal amount of rainfall there was much more rough cotton in

TABLE 6. The Proportional Reduction in Grade Due to Rough Preparation in Relation to the Rainfall and the Number of Rainy Days, by Months, by Districts, Louisiana, 1942-1944

District and Month	1942				1943				1944			
	Crop ginned	Reduced grade	Rain-fall	Rainy days	Crop ginned	Reduced grade	Rain-fall	Rainy days	Crop ginned	Reduced grade	Rain-fall	Rainy days
	%	%	Inches	Days	%	%	Inches	Days	%	%	Inches	Days
I. Red River Delta												
August	5.8	69.5	6.90	12.5	30.0	3.3	0.85	2.2	4.3	30.8	5.93	8.4
September	53.7	20.6	2.62	7.1	34.2	4.4	3.80	8.6	31.8	27.5	2.45	6.0
October	39.0	3.6	1.25	3.7	26.8	2.4	1.78	2.9	39.3	4.6	0.65	1.4
November	1.5	5.3	1.44	5.1	7.3	0.1	2.44	3.9	19.3	2.5	6.34	8.6
December	0.0	0.0	3.86	9.0	1.7	0.0	4.47	8.7	5.3	14.6	9.49	10.5
Total	100.0	16.6	16.07	37.4	100.0	3.2	13.34	26.3	100.0	13.2	24.86	34.9
II. North Louisiana Upland												
August	2.7	60.8	4.02	11.9	22.7	0.5	0.93	1.8	1.8	14.3	9.07	10.4
September	48.4	20.9	3.25	6.4	69.9	8.2	3.47	8.5	36.5	35.9	1.53	5.0
October	44.6	11.4	0.72	3.7	7.4	3.7	2.08	3.0	35.7	11.4	0.48	1.7
November	4.3	29.6	0.96	2.9	0.0	0.0	2.48	4.8	19.5	24.8	6.59	10.0
December	0.0	0.0	4.43	10.9	0.0	0.0	4.45	11.8	6.5	48.8	11.35	13.5
Total	100.0	18.1	13.38	35.8	100.0	6.1	13.41	29.9	100.0	25.5	29.02	40.6
III. Mississippi River Delta												
August	9.3	54.3	3.43	9.1	24.6	4.5	0.91	2.3	0.7	37.3	6.27	9.4
September	47.7	21.5	3.07	7.6	36.5	6.1	6.12	9.3	49.0	30.5	1.67	5.9
October	37.3	2.2	1.84	4.1	25.4	4.1	1.63	3.4	42.6	5.2	0.48	1.6
November	5.7	1.0	1.26	3.4	10.5	2.6	3.01	4.5	6.0	9.3	5.35	8.7
December	0.0	0.0	6.53	9.7	3.0	0.3	3.92	9.5	1.7	5.2	7.51	11.8
Total	100.0	16.2	16.13	33.9	100.0	4.7	15.59	29.0	100.0	18.1	21.28	37.4
IV. South Louisiana												
August	23.6	65.5	4.66	14.1	39.4	23.0	2.71	5.1	28.2	36.7	6.52	14.9
September	63.6	38.7	6.69	7.1	51.5	20.2	11.38	10.5	54.4	44.6	4.58	7.3
October	11.9	7.1	3.63	6.6	8.9	4.3	1.65	2.1	16.7	8.1	1.62	2.6
November	0.9	7.5	1.25	2.9	0.2	3.0	5.35	4.6	0.3	37.0	8.35	8.5
December	0.0	0.0	7.07	8.1	0.0	0.0	6.90	9.8	0.4	18.2	5.74	8.9
Total	100.0	41.0	23.30	38.8	100.0	17.9	27.99	32.1	100.0	36.2	26.81	42.2

Districts II and IV than in the other two districts. With an average monthly rainfall of 5 inches, approximately 15 per cent of the cotton in District III, 18 per cent in District I, and 25 per cent in Districts II and IV was reduced in grade because of rough preparation.

A number of factors may be responsible for this relationship. District IV is located in the lower delta and coastal areas of the state and the moisture content of the cotton produced there is somewhat higher than in other areas of the state. Conditions in the area lead to a rank, dense growth of foliage hindering the natural drying out of the cotton in the field. The cotton harvesting season is relatively short because of its conflict with the sugar cane and rice harvest. A relatively large proportion of the crop is ginned while green and during a period of heavy rainfall. Because of the practice of selling cotton on a "hog-round" basis in this area, growers are more lax in the careful handling of their cotton before it reaches the gin.

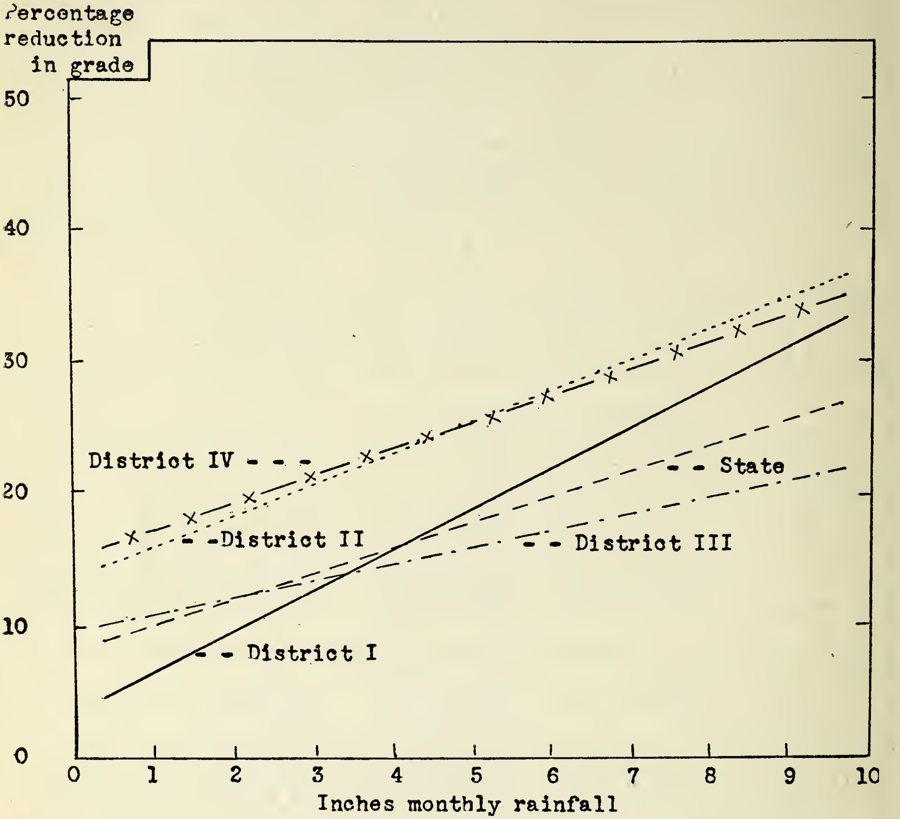

FIGURE 3.—Relation Between Per Cent of Cotton Reduced Because of Rough Preparation and Average Monthly Rainfall, by Districts, August-December, 1942-44.

The normal moisture content of cotton in District II is relatively low compared with that in District IV. Rainfall during the early part of the harvesting season is somewhat less and the plant does not have a rank, dense growth of foliage. District II is predominantly a small farm area. The gins located there are relatively small and scattered. Less emphasis has been placed on equipping gins in the district to handle damp cotton. Growers are able to keep up with their picking as fast as the cotton opens, and a relatively large proportion of the cotton is delivered to the gin in a green, immature condition. As a result, a small amount of rainfall has a greater effect on the preparation of the cotton than would be expected.

There is very little difference in the relationship of rainfall to rough preparation between District I and District III. The difference that does exist may result from variations in gin equipment.

The data in Table 6 indicate that there is a relationship between the amount of rainfall, number of rainy days and the percentage of rough preparation. A decrease in the amount of rainfall and number of rainy days is followed by a decrease in the percentage of rough preparation in each district. The relationship is not as pronounced during the latter part of the season as it is during August, September, and October. In each district the rainfall and number of rainy days, during August and September, were largest in 1942 and 1944, and smallest in 1943. The percentage of rough preparation during August and September was also greatest during 1942 and 1944, and smallest in 1943.

The number of partly cloudy days has a direct relationship to the percentage of cotton reduced one or more grades because of rough preparation. Rainfall followed by cloudy days tends to cause a greater percentage of cotton to be ginned rough than does rainfall followed by clear days.

The relative humidity in the various districts may be partly responsible for the difference in the relationship of rainfall to preparation in these districts. The relative humidity is highest in District IV, where the greatest percentage of rough preparation occurs.

All weather conditions which affect in any way the moisture content of the seed cotton are related to the percentage of cotton ginned reduced in grade because of rough preparation. Conditions which increase the moisture content of cotton tend to increase the percentage of cotton reduced in grade.

Gin Machinery and Operations in Relation to Rough Preparation

Weather conditions and the practice on the part of some farmers of taking green and wet cotton to the gin are responsible for a large portion of the cotton reduced in grade because of rough preparation in Louisiana. Some of the blame for rough preparation, however, must be assigned to the gin and ginner. The condition of ginning equipment and its method of operation are important factors influencing the quality of service rendered. Studying the 39 gins from which data were secured during 1946, it was found that a small number of gins in each district accounted for a large proportion of the cotton reduced in grade because of rough preparation. By avoiding these gins, growers could have materially lowered the amount of cotton reduced in grade.

The two factors most frequently found to be the cause of rough gin preparation are operation of the gin with a tight seed-roll and failure to dry seed cotton of high moisture content before ginning. Grade differences due to change in seed-roll density amounted to nearly two-thirds of a grade in favor of the loose-roll in tests carried out at the United States Ginning Laboratory.[1] Thirty-one out of the 39 gins surveyed in Louisiana ginned with loose to medium loose rolls. In each district the percentage of cotton reduced in grade because of rough preparation was less at gins using a loose-roll than at gins using a tight-roll (Table 7).

Since the moisture in seed cotton is one of the most important factors affecting the operation of a cotton gin and the quality of the ginned lint, it is very important that gins in areas where the moisture content of seed cotton is high be equipped with driers. Tests made at the Ginning Laboratory have shown that the higher the moisture content, the greater the improvement through the use of drying equipment.[2] However, the drier should be used to make good cotton better rather than to encourage growers to deliver wet cotton.

Twenty-seven of the 39 gins surveyed in Louisiana during 1946 had some type of drying equipment. The largest percentage of driers was found in Districts III and IV. Approximately one-half of the gins in District I and one-third of the gins in District II had driers. In each district the percentage of rough preparation was considerably less for those gins with driers than for those without (Table 8). Since all of the gins surveyed in District IV possessed drying equipment, the high percentage of rough preparation in the area indicates that factors other than drying equipment have considerable influence on the amount of rough preparation. Driers were not designed for efficient drying of extremely wet cotton, considerable amounts of which were ginned in District IV.

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[1] Charles A. Bennett and F. L. Gerdes, *Effects of Gin-Saw Speed and Seed-Roll Density on Quality of Cotton Lint and Operation of Gin Stands.* Washington: United States Department of Agriculture, Technical Bulletin No. 503, February, 1936.

[2] F. L. Gerdes and C. A. Bennett, *Effect of Artificially Drying Seed Cotton Before Ginning on Certain Quality Elements of the Lint and Seed and on the Operation of the Gin Stand.* Washington: United States Department of Agriculture, Technical Bulletin No. 508, May, 1936.

TABLE 7. Influence of Seed-Roll Density on Rough Preparation of Cotton, by Districts, Louisiana, 1946

District	Usual Density of Seed-roll											
	Loose				Medium loose				Tight			
	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade
I. Red River Delta.....	8	325	6,894	4.7	2	121	1,124	10.8	3	142	1,458	9.7
II. North Louisiana Upland....	2	240	832	28.8	1	43	116	37.1	0	0	0	0
III. Mississippi River Delta.....	10	213	5,518	4.9	2	0	367	0.0	3	145	1,958	7.4
IV. South Louisiana......	5	837	2,799	29.9	1	130	723	18.0	2	505	1,429	35.3

TABLE 8. INFLUENCE OF DRIERS ON ROUGH PREPARATION OF COTTON, BY DISTRICTS, LOUISIANA, 1946

District	With driers				Without driers			
	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade
I. Red River Delta	7	311	6,357	4.9	6	277	3,119	8.9
II. North Louisiana Upland	1	75	528	14.2	2	208	420	49.5
III. Mississippi River Delta	11	272	6,354	4.3	4	86	1,489	5.8
IV. South Louisiana	8	1,472	4,951	29.7	0	0	0	0

TABLE 9. INFLUENCE OF SAW SPEED ON ROUGH PREPARATION OF COTTON, BY DISTRICTS, LOUISIANA, 1946

District	Saw speed							
	600 RPM and above				400 to 599 RPM			
	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade
I. Red River Delta	7	303	6,391	4.7	6	285	3,085	9.2
II. North Louisiana Upland	3	283	948	29.9	0	0	0	0
III. Mississippi River Delta	8	243	5,222	4.7	7	115	2,621	4.4
IV. South Louisiana	6	1,313	4,457	29.5	2	159	494	32.2

TABLE 10. INFLUENCE OF CLEANING EQUIPMENT ON ROUGH PREPARATION OF COTTON, BY DISTRICTS, LOUISIANA, 1946

District	With cleaning equipment				Without cleaning equipment			
	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade
I. Red River Delta	9	441	7,782	5.7	4	147	1,694	8.7
II. North Louisiana Upland	2	240	832	28.8	1	43	116	37.1
III. Mississippi River Delta	7	141	4,328	3.2	8	217	3,515	6.2
IV. South Louisiana	2	315	968	32.5	6	1,157	3,983	29.0

TABLE 11. RELATIONSHIP OF TYPE OF FEEDER TO ROUGH PREPARATION OF COTTON, BY DISTRICTS, LOUISIANA, 1946

District	Type of feeder							
	Unit Extractors				Big Drum			
	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade	Number of gins	Number of bales reduced one or more grades	Total number of bales ginned	Percentage total ginnings reduced in grade
I. Red River Delta	12	535	9,107	5.9	1	53	369	14.4
II. North Louisiana Upland	0	0	0	0	3	283	948	29.9
III. Mississippi River Delta	14	348	7,539	4.6	1	10	304	3.3
IV. South Louisiana	6	1,313	4,457	29.5	2	159	494	32.3

Tests made at the Cotton Ginning Laboratory have proved that variations in gin saw speeds have very little effect on the quality of cotton ginned.[3] However, with the higher saw speeds, it is easier to maintain a loose seed-roll, which does improve the quality of ginning. Modern gins are being stepped up in saw speeds to 600 revolutions per minute or more, which helps to provide looser seed-rolls, smoother ginning, and better capacity and turnout.[4]

Data on gins surveyed in Louisiana show that those gins having saw speeds of 600 revolutions per minute and above had a smaller percentage of cotton reduced in grade because of rough preparation than did those with saw speeds of less than 600 revolutions per minute (Table 9). Gins in District III with saw speeds of less than 600 revolutions per minute had a slightly smaller percentage of rough preparation than did those with 600 and above. However, this is accounted for by the fact that these gins were better equipped otherwise. In selecting the right gin to patronize, growers should remember that even though a particular factor may be very important, other things must be kept in mind also.

The relationship of cleaning equipment to rough gin preparation is shown in Table 10. Approximately one-half of the gins surveyed possessed some cleaning equipment. In each district, with the exception of District IV, those gins with cleaning equipment had the smallest percentage of rough preparation. In District IV one of the two gins possessing cleaning equipment ginned with a tight seed-roll, which resulted in the percentage of rough preparation being relatively high for the gins possessing cleaning equipment in this area.

The relationship of type of feeder to rough preparation is shown in Table 11. Those gins equipped with unit extractor feeders had a considerably smaller percentage of rough preparation than did those equipped with big drum feeders. Most modern gins are equipped with unit extractor feeders, whereas, the small, older gins are usually equipped with big drum feeders; also, many of the gins have heat in the extractor feeders which helps to reduce the amount of rough preparation. The largest proportion of gins equipped with big drum feeders is found in District II.

The study shows that gins with 80 saws per stand had less than one-half the amount of rough preparation as those with 70 saws per stand, and gins with four or more stands had a smaller proportion of rough cotton than those with less than four stands. In general, gins having the largest volume of ginning had the smallest amount of rough preparation. These relationships, however, were due to factors other than the number of saws per stand, the number of stands per gin, and the volume of ginning. The majority of the 80-saw gins were modern, well-equipped establishments, whereas the 70-saw gins were mostly old and obsolete. Gins with four or more stands generally had a greater volume of ginning, which made it possible for them to keep their equipment up-to-date and in better repair than those with fewer stands. Gins with a larger volume of ginning were better able to hire competent operators and were generally more adequately equipped than gins having a small volume.

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[3] C. A. Bennett and F. L. Gerdes, *Effects of Gin-Saw Speed and Seed-Roll Density on Quality of Cotton Lint and Operation of Gin Stands.* Washington: United States Department of Agriculture, Technical Bulletin No. 503, Feb., 1936.

[4] C. A. Bennett and F. L. Gerdes, *Cotton-Gin Maintenance.* Washington: United States Department of Agriculture, Leaflet No. 216, May, 1942.

Rough Preparation May Be Reduced

Cotton farmers can help to reduce the amount of rough preparation by furnishing the ginner with cotton in good ginning condition. They can demand also that the ginner employ effective ginning methods that will best preserve lint quality.

Growers have no control over weather conditions during the harvest season; however, they can reduce the amount of rough preparation through the use of better harvesting practices. Whenever possible, growers should avoid picking cotton with too much moisture because of greenness or exposure to rain or dew. If cotton is picked containing too much moisture, it should be dried as much as possible before being carried to the gin. Early morning dew-laden pickings should be sun-dried before being placed in the wagon or seed cotton house. Cotton containing too much moisture because of greenness or exposure to rain or dew should never be mixed with dry cotton and immediately taken to the gin. Green, damp or moderately wet seed cotton stored on the farm should be turned and aired to aid drying and prevent heating. If weather conditions prevent the sun-drying of seed cotton, it should be taken to a gin equipped with a mechanical drier.

Growers should be careful in the selection of the gin to which they carry their cotton. A gin inadequately equipped and poorly operated may cost the grower all of the advantage he has gained through the careful handling of his cotton. The grower should encourage the ginner to take the time necessary to do a proper job of ginning and encourage him to make necessary improvements and maintain his equipment in good repair.

Ginners can help to preserve the inherent quality of cotton by adopting the very best ginning practices and methods. Modern gin equipment and better ginning establishments will improve the quality of ginned lint. Ginners can insist that growers furnish them with cotton in good ginning condition and encourage them to employ better harvesting practices.

Close cooperation between the grower and the ginner in harvesting and ginning will decrease the amount of rough preparation in Louisiana and add materially to the value of the cotton crop.

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Summary and Conclusions

1. Preparation, one of the three factors determining the grade of cotton, denotes the degree of smoothness with which cotton is ginned. It is directly related to the moisture content of the seed cotton, the condition of ginning equipment and its method of operation. During the past few years, the percentage of rough preparation in Louisiana has increased and has resulted in the loss of important outlets for Louisiana cotton. The value of the cotton crop could be increased by a reduction in rough preparation.

2. Louisiana has a higher percentage of rough preparation than any of her neighboring states or the United States, as a whole, and has the third highest among the 14 major cotton-producing states. The South Louisiana Cotton Area, District IV, has the highest percentage of rough preparation within the state and the Upland Cotton Area, District II, ranks second. The percentage of cotton reduced in grade because of rough preparation is smaller for short staple cotton than it is for cotton with a staple of one and one-eighth inches and longer.

3. The largest percentage of monthly ginnings reduced one or more grades because of rough preparation and the largest amount of rainfall and rainy days occur during the months of August and September. In addition, a relatively large proportion of the cotton ginned during these months is picked in a green, immature condition. Although a given amount of rainfall does not have the same effect each year, a given amount during August and September has more nearly the same effect than a like amount later in the season. The same was found to be true for a given number of rainy days.

4. In each district an increase in rainfall was accompanied by an increase in the percentage of rough preparation. With an equal amount of rainfall there was a greater percentage of rough cotton in Districts II and IV than in the other two districts. The moisture content of the seed cotton when ginned, due to differences in weather conditions between districts, was the main factor responsible for this relationship. Any weather condition which increased the moisture content of seed cotton tended to increase the percentage of cotton reduced in grade.

5. Rough preparation is not wholly due to weather conditions and the ginning of high moisture content cotton. Gins using a loose seed-roll, drying equipment, high saw speeds, cleaning equipment and unit extractor feeders were found to have considerably less rough preparation than other gins. The more modern, well-equipped gins had a smaller percentage of rough preparation than did the older, obsolete gins.

6. To promote good ginning, growers should furnish the ginner with cotton in good ginning condition. They should avoid delivering cotton that is moist because of greenness or exposure to rain or dew. The grower should insist that the ginner employ those ginning methods that will best preserve lint quality. The ginner can promote good ginning through the use of modern gin equipment and better ginning practices.

93 l

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AN ECONOMIC STUDY OF THE FARM STORAGE OF SWEET POTATOES IN LOUISIANA

By

MARSHALL E. MILLER AND MARTIN D. WOODIN

TECHNOLOGY AND SCIENCE ROOM

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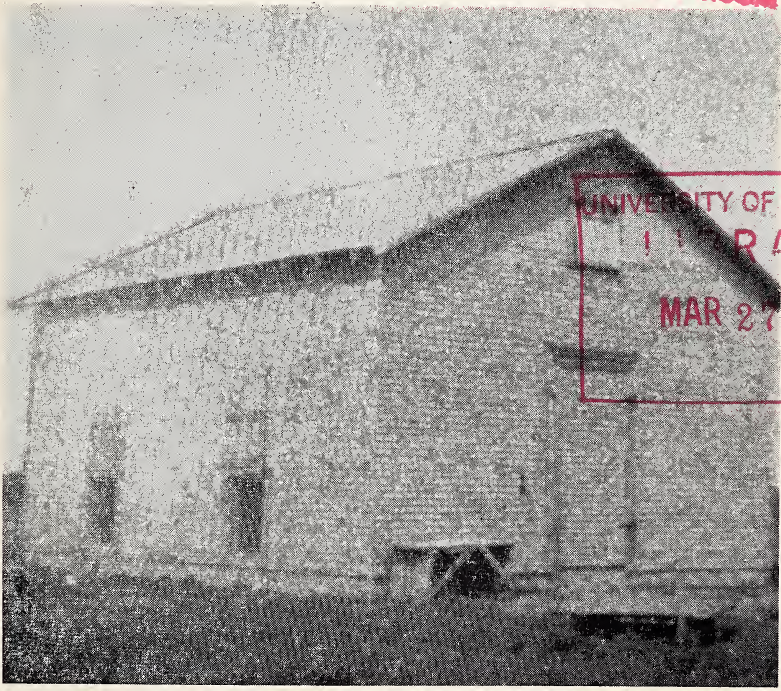

A Farm Storage for Sweet Potatoes in the Commercial Sweet Potato Producing Area of Southwest Louisiana

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, Director

TABLE OF CONTENTS

Page

INTRODUCTION 3
  Purpose of Study 3
  Sources of Information 4

MARKETING PRACTICES OF FARM STORAGE OWNERS 4
  Disposition of Crop 4
  Handling of Marketable Crop and Market Outlets 5

FARM STORAGE OPERATIONS AND PRACTICES 5
  Description of Storages 6
  Capacity and Cost 6
  Use of Farm Storages 7
  Grades of Sweet Potatoes Stored 7
  Movement of Marketable Sweet Potatoes Into and Out of Storage 8
  Regrading Practices and Storage Losses 9

STORAGE COSTS 10
  Crates 10
  Interest and Depreciation 10
  Labor and Direct Cash Costs 11
  Price Increase Necessary to Offset Storage Losses 12
  Summary of Storage Costs 13

FINANCIAL RESULTS FROM STORING SWEET POTATOES ON THE FARM 14
  1946 and 1947 Crops 14
  Seasonal Price Patterns and Probable Results from Storing Over a Period of Years 15

SUMMARY 21

An Economic Study of the Farm Storage of Sweet Potatoes in Louisiana

By

MARSHALL E. MILLER AND MARTIN D. WOODIN

Introduction

Commercial producers of sweet potatoes in Louisiana are faced with making the decision of whether to sell their crop when dug or to store all or part of it in anticipation of price increases as the marketing season progresses. Formerly, nearly all commercial growers sold their crop shortly after harvest.[1] Storing for sale after the harvesting season was mainly in the hands of shippers who held large quantities of sweet potatoes in commercial storage houses. While the greater part of each year's crop is still sold by growers at harvesttime and dealers do a large part of the storing, storage on the farm for late season sale has increased during recent years. Farm storage is most prevalent in the Opelousas-Sunset area.

The storage of sweet potatoes is necessary in order that consumption of the crop can be spread over a relatively long period. To attempt to force consumption of the entire production during a short period would result in disastrously low prices. However, from the standpoint of the individual grower, the object of storing marketable sweet potatoes is to make more money than could be made if the crop were sold at digging time.[2] In order to properly store and keep sweet potatoes in good condition, it is usually necessary to have a specially constructed storage house. For the individual grower, the cost of building and maintaining the storage house, shrinkage and losses from decay, and other costs must be more than covered by the increase in price received for stored sweet potatoes. Otherwise, the storage function would have to be performed by others, such as middlemen, who may be better prepared to assume the burden of storage risks.

Purpose of Study

This report presents an analysis of storage results and marketing practices of farm storage owners for the 1946-47 and 1947-48 seasons.[3] Costs incurred in storing, the advantage gained by storing a portion of the 1946 and 1947 crops, and the probable outcome from storing over a period of years are discussed. Such information should be useful to farm storage owners as a guide in deciding when to market each year's crop. Growers who do not store any of their sweet potatoes for late season sale will have a more reliable basis for deciding whether or not to build a storage house.

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[1] Commercial sweet potato production in Louisiana is largely concentrated in three areas of the state; namely, the Opelousas-Sunset area in St. Landry and adjoining parishes, the St. Francisville area in West Feliciana Parish, and the Oak Grove area in West Carroll Parish.

[2] Obviously, if all growers were to store their sweet potatoes for sale during the late winter and spring months, prices in the fall would be increased and spring prices lowered. A large number of growers probably will always market their crop in the fall because of the need for cash, lack of storage facilities, desire to avoid the trouble and hazards of storage, and for other reasons.

[3] By "farm storage" is meant a specially constructed building for storing sweet potatoes. Most sweet potato growers, including those who do not own storages, normally store part of their crop in some way, for example, in barns or sheds. Such holdings are used mainly for feed, seed, or home use, and not for later commercial sale.

Sources of Information

Data on storage and marketing practices for the 1946-47 season were obtained from 59 farm storage owners in the Opelousas-Sunset area. A less detailed study of 26 farm storages was made in 1947-48 to check cost and loss rates and the influence of adverse storage results in 1946-47 on storage and marketing operations in 1947-48.

Data presented in this report other than that gathered from farmers are from published statistics.

Marketing Practices of Farm Storage Owners

Disposition of Crop

The 59 farm storage owners interviewed in the Opelousas-Sunset area produced 201,684 crates of sweet potatoes in 1946.[4] Fifty per cent of this production was placed in storage on the farm for sale later in the marketing season, while only 19.5 per cent was sold when dug (Table 1). About 30 per cent, consisting mainly of culls and strings, was utilized for feed, seed, and home use.

The 26 farm storage owners studied during the 1947-48 season stored 37 per cent of their total production of 110,469 crates, and sold about 40 per cent when dug. Because of unfavorable prices late in the spring of 1947, growers were more cautious in storing sweet potatoes during the 1947-48 season. Of the 31 storage owners interviewed, 5 did not store any of the 1947 crop.

TABLE 1. Disposition of Sweet Potato Crop by Farm Storage Owners, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons*

	1946-47		1947-48	
	No. of crates	Per cent of total	No. of crates	Per cent of total
Marketable sweet potatoes stored	100,896	50.0	41,014	37.1
Fresh sales†	39,232	19.5	43,627	39.5
Feed, seed, & home use‡	61,556	30.5	25,828	23.4
Total crop	201,684	100.0	110,469	100.0

*Based on 59 farm storages in 1946-47, and 26 farm storages in 1947-48.

†Sweet potatoes sold in a green or uncured condition shortly after being dug are referred to as "fresh" sales.

‡In 1946-47, storage owners dehydrated 8 per cent of total production and used 22.5 per cent as raw feed, seed, and home use. In 1947-48, 13.6 per cent of their total crop was dehydrated, 6.9 per cent fed raw, 2.7 used for seed, and 0.2 per cent for home use.

The use of sweet potatoes as a livestock feed is an important means of utilizing that portion of the crop not suitable for shipping or canning. Sweet potatoes may be fed either raw or dehydrated. Dehydrated sweet potatoes as a feed are becoming increasingly popular, and most of the storage owners dehydrated part of their culls. In 1946-47 and 1947-48, dehydrated sweet potatoes for feed amounted to 8 and 14 per cent, respectively, of the total production of the storers contacted. Dehydration is also important in the control of the sweet potato weevil.

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[4] In Louisiana sweet potatoes are generally stored in crates which hold 5 pounds less than the official 55-pound bushel. Storage capacity and other storage data in the remainder of this report are based on the crate as the standard unit of measurement used in the sweet potato trade.

Handling of Marketable Crop and Market Outlets[5]

Early sweet potatoes, those dug in July, August, and early September, are generally sold fresh. These early sales were relatively small, representing 10.6 per cent of the total marketable crop in 1946-47, and 7.5 per cent in 1947-48 (Table 2). The proportion of fresh sales and storage holdings from the main fall crop differed considerably in the two seasons. Fresh sales from the main crop amounted to 17.4 per cent of the marketable sweet potatoes produced in the 1946-47 season and 44.0 per cent in 1947-48, while 72.0 per cent was placed in storage in 1946-47 and only 48.5 per cent in 1947-48. The light movement into storage on the farm in the fall of 1947 was not caused by any significant difference in prices because fresh sales averaged $1.33 per crate compared with $1.35 in the fall of 1946. The unfavorable returns from storage in the spring of 1947 caused most farm storage owners to be cautious about storing too heavily in the fall of that year.

TABLE 2. Fresh Sales and Storage of Early and Main Crop of Marketable Sweet Potatoes by Farm Storage Owners, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47	1947-48
	(Per cent of marketable crop)	
Early crop:		
Fresh sales	10.6	7.5
Stored	0	0
Main crop:		
Fresh sales	17.4	44.0
Stored	72.0	48.5
Total	100.0	100.0

Local shippers and truckers provide the major market outlet for both fresh and stored sweet potatoes, although some growers sell through their own cooperatives, truck direct to market, or sell to processing plants. Shippers and truckers handled 84 per cent of the marketable crop of the 59 growers interviewed in 1946-47.

During the war years it was the practice of buyers to purchase ungraded sweet potatoes from growers at the farm. Crates, costs of hauling, and other marketing charges were paid by the buyers and were reflected to the grower in lower prices per crate. With the disappearance of a "sellers' " market, it is likely that sales by growers will be made on a graded basis to a greater extent.

Farm Storage Operations and Practices

The practice of storing sweet potatoes on the farm for sale later in the marketing season has become more widespread in recent years. This is evidenced by the fact that in the Opelousas-Sunset area, 11 of the 59 storages surveyed in 1946-47 were built in 1946 and 12 were built in 1945. Only 10 were constructed prior to the beginning of the war.

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[5] "Marketable crop" refers to that portion of the total crop which is sold for table use or canning, and normally does not include cull and stringy sweet potatoes.

Although some growers had been keeping a small part of their marketable crop in other farm buildings, some owners of new storages stored marketable sweet potatoes for the first time in 1946. Growers are able to store larger quantities of sweet potatoes and keep them in better condition if they have specially constructed storage houses. Capital accumulated as a result of high prices received for farm products during recent years and the favorable results from storage in 1944-45 and 1945-46 encouraged more growers to construct sweet potato storages.

Description of Storages

Storage houses in the Opelousas-Sunset area usually are frame buildings designed specifically for the storage of sweet potatoes.[6] Concrete foundations with earth floors are most common, although a few storages have concrete floors. Ventilation usually is provided through openings in each gable end and through side windows and doors. Heat, if needed, is generally provided through the use of gas heaters and oil or wood stoves.

Capacity and Cost

The 59 storages studied in 1946-47 ranged in capacity from 500 to 20,000 crates, and averaged 3,545 (Table 3). Average holdings were 2,744 crates, which included the storage owner's crop, purchases for resale, and holdings for other growers. In 1947-48, the storages studied were slightly larger, averaging 4,561 crates, and the quantity stored amounted to 3,179 crates per storage.

The original cost of the storages studied in 1946-47 was $467, ranging from an average of $264 for small storages to $1,176 for large storages. The investment in the storage house per crate of capacity decreased as the size of storage increased. The capacity of the large storages was approximately 4 times as great as that of storages in the middle group, while cost of building was less than 3 times as great, $1,176 as compared with $400. When capacity and cost of large storages are compared with small storages, the ratio between capacities is 9 to 1, while the ratio between cost of building is 4.5 to 1.

TABLE 3. Capacity and Cost of Farm Storages, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

Average per storage or storage owner	1946-47				1947-48
	Size of storage (Crate capacity)				
	Less than 2000 (Small)	2000-4800* (Medium)	6000 or more (Large)	All storages	All storages
Capacity (crates)	1,199	2,807	11,222	3,545	4,561
Crates stored†	950	2,042	9,072	2,744	3,197
Cost of building	$264	$400	$1,176	$467	$523
Acres in sweet potatoes	11	17	30	17	21
Production (crates)	1,878	3,312	7,086	3,401	4,249
Number of storages	20	30	9	59	26

* No storages reporting 4800 to 6000 crates.
† Includes storings for others and purchases for resale.

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[6] Building specifications and recommended materials for sweet potato storage houses may be obtained through the Louisiana Agricultural Extension Service or the County Agent.

Use of Farm Storages

Storage space is utilized to store the grower's own crop, purchases for resale, and holdings for others. Total storage space available was not fully used in either of the two years studied (Table 4). In 1947-48 only about 70 per cent of total capacity was used as compared with 77 per cent in 1946-47. In the earlier season, two-thirds of the sweet potatoes stored were the storer's own crop, while in 1947-48 only about one-half of storage holdings were produced by the storage owner. A larger proportion of the holdings in 1947-48 were sweet potatoes purchased for resale or stored for other growers. Owners of large storages tend to use more of their capacity for storing for other growers or for holding sweet potatoes which they purchase for resale. The practice of storing for others, where possible, seems to be desirable for growers who do not use their storage houses to capacity. Receipts from such custom storing reduce storage costs on the grower's own sweet potatoes, since total depreciation and interest costs on the storage investment are the same whether or not the storage is fully utilized.

TABLE 4. Utilization of Storage Space in Farm Storages, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47		1947-48*	
	Per cent of total stored	Per cent of total capacity	Per cent of total stored	Per cent of total capacity
Storage of own crop (all grades)	66.1	51.2	51.3	36.0
Purchases for resale	8.8	6.8	19.9	14.0
Storage for others	25.1	19.4	28.8	20.2
Total stored	100.0	77.4	100.0	70.2
Total storage capacity	—	100.0	—	100.0
Unused portion of storage capacity	—	22.6	—	29.9

*Based on 26 farm storages actually storing sweet potatoes in 1947-48. Five of 31 owners contacted did not store any. If their total storage capacity were used in making calculations, only 54.6 per cent of total capacity would have been utilized.

Grades of Sweet Potatoes Stored

Most of the sweet potatoes stored on the farm are unclassified as to grade.[7] The sweet potatoes are partially graded in the field while being packed in crates for storage by sorting out the culls, strings, and damaged tubers. Usually no attempt is made to separate the No. 1 and No. 2 grade sweet potatoes in the field. Only about 7 per cent of the sweet potatoes stored by the growers surveyed were packed separately as No. 1 and No. 2 grades during the 1946-47 season, and only 11 per cent in 1947-48 (Table 5). Culls not dehydrated at digging time are normally stored in bulk in barns, corn cribs, and other farm buildings.

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[7] Grades of sweet potatoes commonly used in the Louisiana sweet potato trade are U.S. No. 1, U. S. No. 2, and an unofficial grade known sometimes as "Commercial," which consists of field-run sweet potatoes with the culls removed and contains from 60 to 80 per cent No. 1's and the remainder No. 2's. Commercial grade is often called a "percentage" pack. On August 1, 1948, the official U. S. grades became U. S. Extra No. 1, U. S. No. 1, U. S. Commercial, and U. S. No. 2.

TABLE 5. Grades of Sweet Potatoes Stored by Farm Storage Owners, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

Grades stored	1946-47		1947-48	
	Crates	Per cent of total	Crates	Per cent of total
No. 1*	7,800	6.2	3,300	5.6
No. 2	880	0.7	3,200	5.4
Unclassified	110,316	88.2	51,059	86.3
Culls†	6,095	4.9	1,625	2.7
Total - all grades‡	125,091	100.0	59,184	100.0

* Most No. 1 grade sweet potatoes were stored by the large storers.

† Includes only those culls stored in the sweet potato storage house. Culls are frequently stored in other farm buildings.

‡ Does not include holdings for others. Storage holdings for others were all unclassified as to grade.

Movement of Marketable Sweet Potatoes Into and Out of Storage

Sweet potatoes are normally placed in storage from late September to the middle of November. Movement out of storage begins in volume in December and usually by April the bulk of farm storage holdings have been sold, although in the past some sweet potatoes were held longer.

During the past two seasons, state regulations for weevil control required that all stored sweet potatoes in areas under quarantine had to be disposed of by May 1. In the 1946-47 season, only 4.6 per cent of storage holdings had been moved by December 31 and only 17.2 per cent by January 31, while in 1947-48 nearly 62 per cent had been moved by January 31 (Table 6). Unfavorable prices in the winter months of 1946-47 and the spring deadline of shipments in the quarantine area resulted in a light movement early in the season followed by heavy shipments from February through April. The 1947-48 season followed the usual seasonal pattern of movement out of storage more closely, although movements in volume occurred earlier than might normally be expected.

TABLE 6. Movement of Sweet Potatoes Into and Out of Storage by Farm Storage Owners, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47		1947-48	
	Crates*	Per cent of total	Crates*	Per cent of total
Crates of marketable sweet potatoes stored†	118,996	100.0	57,559	100.0
Monthly removals:				
October	0	0	1,000	1.7
November	1,612	1.4	0	0
December	3,750	3.2	14,430	25.1
January	15,080	12.6	20,090	34.9
February	25,069	21.1	11,114	19.3
March	35,412	29.7	5,200	9.0
April	38,073	32.0	5,725	10.0

* Includes sweet potatoes purchased and stored for later sale.

† Sweet potatoes dug early in the season generally are not stored. Most sweet potatoes are placed in storage in the latter part of September, October and November.

Regrading Practices and Storage Losses

There was a direct relationship between the grade of sweet potatoes sold out of storage and storage losses reported. In 1946-47, large storage owners sold a greater proportion of their storage holdings on a regraded basis (Table 7). They sold 67.2 per cent as No. 1's, 24.0 per cent as No. 2's, and only 8.8 per cent unclassified as to grade. As a result of extensive regrading, the average loss rate for large storages was 20.6 per cent of the marketable sweet potatoes stored, which exceeded losses in medium and small storages whose owners regraded to a lesser extent. Medium and small storage owners reported loss rates of 14.4 per cent and 11.5 per cent, respectively. The average loss rate for all storages in 1946-47 was 16.4 per cent, based on sales of 57.0 per cent of marketable holdings as No. 1's, 17.4 per cent as No. 2's, and 25.6 per cent as unclassified. At this rate, the average loss of stored sweet potatoes would have been about 20 per cent if all sweet potatoes sold had been graded into No. 1 and No. 2 grades.

In 1947-48, storage owners sold an even greater volume of sweet potatoes as they stood in the kiln, that is, on a crate-for-crate basis as originally placed in storage. Only 13.2 per cent of removals were sold as No. 1's and 8.8 per cent as No. 2's, while 78.0 per cent were sold unclassified as to grade. As a consequence, a storage loss rate to the storage owner of only 7.6 per cent was reported. The highly competitive market probably accounted for the large amount of sweet potatoes sold unclassified as to grade by farmers. It is likely that in the future more

TABLE 7. Grades of Stored Sweet Potatoes Sold and Farm Storage Losses, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47				1947-48
	Size of storage				
	Large	Medium	Small	All storages	All storages
Marketable sweet potatoes stored*	45,131	56,260	17,605	118,996	57,559
Grades sold (crates)					
No. 1	24,067	26,682	5,995	56,744	7,039
No. 2	8,583	7,188	1,586	17,357	4,665
Unclassified	3,170	14,264	8,003	25,437	41,470
Total	35,820	48,134	15,584	99,538	53,174
Losses†					
Crates	9,311	8,126	2,021	19,458	4,385
Per cent of total crates stored	20.6	14.4	11.5	16.4	7.6
Per cent sold as:					
No. 1	67.2	55.4	38.5	57.0	13.2
No. 2	24.0	14.9	10.2	17.4	8.8
Unclassified	8.8	29.7	51.3	25.6	78.0
Total percentages	100.0	100.0	100.0	100.0	100.0

* Includes grower's own crop and purchases for resale. Sweet potatoes unclassified as to grade made up the bulk of total holdings.

† Based on their packing shed operations, buyers gave the following average regrade rates per crate of sweet potatoes held in storage for a period of 4-6 months: No. 1 - 62 per cent; No. 2 - 18 per cent; loss in marketable sweet potatoes - 20 per cent. Losses are due mainly to shrinkage, decay, and weevil damage. A small proportion of sweet potatoes unfit for sale after regrading and repacking because of rot specks and weevil damage may be used for feed. However, some growers burn the weevil-damaged potatoes or leave them at the packing shed.

sweet potatoes will be sold on a regraded basis. Under such conditions farm storage owners will experience higher average storage and regrading losses.

It is questionable whether or not the farmer receives greater total returns over a period of years if his sweet potatoes are sold unclassified than if he sells on a graded basis. Buyers, in so far as competition permits, normally base their purchasing price for unclassified sweet potatoes on an estimate of what they will pack out. Based on packing shed operations, buyers estimated that a crate of sweet potatoes held in storage for a period of 4 to 6 months would grade out approximately 62 per cent No. 1's, 18 per cent No. 2's, and 20 per cent loss in marketable potatoes. At the prices received for different grades in the spring of 1947 and 1948, other things equal, the farmer would have been better off by approximately 24 cents per crate by selling as unclassified in 1947, but would have increased his receipts by about 9 cents per crate in 1948 by selling as No. 1's and No. 2's, in addition to the salvage value of a few tubers fit for feed. The very low price for No. 2's in the spring of 1947 made it more profitable to sell on an unclassified basis in that year.

Storage Costs

Storage costs consist of crate costs, if crates are bought expressly for storing, depreciation and interest on storage investment, repairs, labor, materials used in storage operations, rodent and insect control, fuel for heating, and losses of sweet potatoes because of decay, insect and rodent damage, and shrinkage.

Crates[8]

Most farm storage owners do not own the crates their sweet potatoes are stored in. Buyers usually furnish the crates and have first option to purchase the stored sweet potatoes if their price is satisfactory to the grower. In the instances where farmers buy their own crates, the crates usually are sold with the sweet potatoes. The average life of crates unsold and kept for re-use is about 2 years. In 1946-47 and 1947-48, crates cost the farmer from 30 to 35 cents each. Thus, in addition to other costs, growers supplying their own crates and re-using them from year to year have annual crate costs of about 15 cents per crate stored. Some growers through good care make their crates last several years, a practice which should be given greater emphasis.

Interest and Depreciation

Interest and depreciation costs are based on the original cost of the storage, estimated length of life, and age. The average estimated life of storages studied in the Opelousas-Sunset area in 1946-47 was 18 years, while the average age was approximately 5 years. The average interest costs on storage investment amounted to $18.70 per storage, while the average annual depreciation cost was $27.04 (Table 8). Total interest and depreciation costs were considerably higher on large storages because of the greater investment; however, because of the relationship between capacity and investment, total interest and depreciation costs per crate stored in large storages were 1.2 cents as compared with 2.9 cents in the case of small storages.

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[8] Since only a few farm storage owners buy their own crates, crate costs have not been included in total storage costs in this report. Prices were adjusted for the value of the crates in those cases where crates were sold with the sweet potatoes.

TABLE 8. Interest and Depreciation Costs of Storing Sweet Potatoes in Farm Storages, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47				1947-48
	Size of storage				
	Large	Medium	Small	All storages	All storages
	(Average per storage)				
Interest on storage investment*	$ 46.50	$ 16.58	$ 10.03	$ 18.70	$ 20.20
Depreciation†	62.00	24.45	15.76	27.04	30.28
Total	$108.50	$ 41.03	$ 25.79	$ 45.74	$ 50.48
Number of crates stored‡	8,961	1,932	878	2,744	3,197
Interest and depreciation cost per crate stored (Cents)	1.2	2.1	2.9	1.7	1.6
Storage capacity (Crates)	11,222	2,807	1,199	3,545	4,561
Interest and depreciation cost per crate if storage had been fully utilized (Cents)	1.0	1.5	2.2	1.3	1.1

* Based on 5 per cent of average value.
† Computed by straightline method.
‡ Includes own crop, purchases for resale, and holdings for others.

The average number of crates of marketable sweet potatoes stored in large storages in 1946-47 was 8,961 compared to 878 in small storages. If all farm storages had been utilized to capacity, average interest and depreciation costs per crate in 1946-47 would have been 1.3 cents, in contrast to the actual cost of 1.7 cents.

The summary study of 26 farm storages in 1947-48 showed interest and depreciation cost figures similar to those reported in 1946-47. These costs per crate stored amounted to 1.6 cents as compared to 1.7 cents in 1946-47.

Labor and Direct Cash Costs

In addition to interest and depreciation, labor and other direct costs are incurred in storing. Labor constituted a major cost item, but in many cases was not a direct cash cost. Man labor required to store sweet potatoes in farm storages in the Opelousas-Sunset area in 1946-47 averaged 180 hours per storage (Table 9). At the prevailing farm wage, labor costs alone would average $54 per storage. The average computed labor costs for large storages was $111, for medium-sized storages $51, and for small storages $32. However, since a large part of the labor requirements was met by operator or family labor, actual cash costs for labor were not as great as these figures would indicate. Labor costs on

26 farm storages in 1947-48, including unpaid family labor, amounted to $61 per storage.

Repairs, fumigation, rat control, and heating costs averaged $11.91 per storage in 1946-47, and $20 per storage in 1947-48. Though sweet potatoes did not remain in storage as long as in 1946-47, heating requirements were considerably greater because of unusually cold weather during the winter of 1947-48.

Labor and other direct costs averaged 3.4 cents per crate for all storages in 1946-47 and 3.6 cents in 1947-48. Costs per crate were lower for large storages because of a greater volume stored. If no labor had been hired in moving the sweet potatoes into and out of storage and in the storage operation, cash operating costs per crate stored would have averaged less than one cent per crate.

TABLE 9. Labor and Direct Cash Costs of Storing Sweet Potatoes in Farm Storages, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47				1947-48
	Size of storage				
	Large	Medium	Small	All storages	All storages
		(Average per storage)			
Preparation of storage*					
Labor (Man-hours)	20	13	10	14	16
Costs of materials (Dollars)	20	9	8	11	8
Movement into and out of storage					
Man-hours per 100 crates	5.4	6.0	6.0	5.6	5.6
Total man-hours	271	106	53	110	127
Operation of storage†					
Labor (Man-hours)	79	52	44	53	61
Cost of materials (Dollars)	1.00	1.00	0.50	0.91	12.00
Total labor and other costs					
Total man-hours	370	171	107	180	204
Value of labor‡ (Dollars)	111.00	51.00	32.00	54.00	61.00
Total other costs (Dollars)	21.00	10.00	8.50	11.91	20.00
Total costs (Dollars)	132.00	61.00	40.50	65.91	81.00
Number of crates stored§	5,015	1,762	878	1,958	2,276
Cost per crate (Cents)	2.6	3.5	4.6	3.4	3.6
Cost per crate excluding labor (Cents)	0.4	0.6	1.0	0.6	0.9

* Includes repairs, cleaning, fumigation, etc.

† Includes heating, ventilation, inspection, rat control, etc. Heating costs were considerably higher during the 1947-48 season.

‡ Computed at 30¢ per hour.

§ Holdings for others not included.

Price Increase Necessary to Offset Storage Losses

By far the largest item of storage cost is that occasioned by losses, which are caused primarily by shrinkage. Other factors affecting loss rates in the Opelousas-Sunset area are decay and weevil damage. As stated previously, actual physical loss rates to the storage owners amounted to 16.4 per cent in 1946-47 and 7.6 per cent in 1947-48. In the latter season, a greater proportion of stored sweet potatoes were sold as they stood in the storage without regrading. In both years, if total storage holdings were sold on a regraded basis, loss rates would amount to approximately 20 per cent. The 16.4 per cent loss rate suffered in 1946-47 amounted to an average loss of 321 crates per storage, while the 7.6 per cent loss rate in 1947-48 occasioned a loss of 173 crates per storage (Table 10). When valued at the sales price which prevailed at digging time, the average value of losses per storage amounted to $433 in 1946-47 and to $230 in 1947-48. In other words, the storage owner could have sold the sweet potatoes lost in storage for these amounts when freshly dug. In order to offset these losses, remaining sweet potatoes fit for sale had to be sold for 26.5 cents more per crate than the fresh sales price in 1946-47, and 10.9 cents more per crate in 1947-48. The price increase necessary to offset storage losses varied with loss rates. Large storages having an average loss rate of 20.6 per cent in 1946-47 required a price increase of 35 cents per crate. Medium-sized and small storages with losses of 14.4 per cent and 11.5 per cent required price increases of 23 and 18 cents per crate, respectively.

TABLE 10. Price Increase Necessary to Offset Farm Storage Losses, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47	1947-48
	Average per storage	
Crates stored	1,958	2,276
Crates actually salable	1,637	2,103
Crates lost	321	173
Losses (Per cent)	16.4	7.6
Value per crate (Dollars) (Average fresh sales price)	1.35	1.33
Value of losses (Dollars)	433	230
Price increase necessary to offset losses (Cents per crate)	26.5	10.9

Summary of Storage Costs

To offset all costs incurred in storing, including losses, an average price increase of 31.6 cents per crate over the $1.35 fresh sales price in 1946-47, and 16.1 cents per crate over the $1.33 fresh sales price in 1947-48, was necessary (Table 11). Therefore, the average price received per crate for stored sweet potatoes had to be $1.67 in 1946-47, and $1.49

TABLE 11. Total Price Increase Necessary to Offset Storage Costs and Losses, Opelousas-Sunset Area, 1946-47 & 1947-48 Seasons

	1946-47*	1947-48
	Average all storages (Cents per crate)	
Labor and direct costs	3.4	3.6
Interest and depreciation	1.7	1.6
Storage losses†	26.5	10.9
Total increase necessary	31.6	16.1

* Large storages had lower costs per crate for labor and overhead items, but required a larger price increase to offset losses than did medium and small storages.

† Price increase necessary to offset losses was much higher in 1946-47 than in 1947-48 because a greater amount of sweet potatoes were sold as No. 1's and No. 2's in the former season. Few stored sweet potatoes were sold by growers on a repack basis in 1947-48.

in 1947-48 for the storage owners to break even. No interest charge was calculated on the farm capital represented by the sweet potatoes held in farm storage, since in most cases there was no direct cash cost to the grower or alternative use for the capital. If an interest charge had been made, it would amount to about one cent per crate.

Storage costs and the necessary offsetting price increase may vary from year to year depending on such factors as the fresh sales price, farm wage rates, cost of materials for repairs, and storage losses. To obtain an idea of what storage costs might be during a so-called "normal" period, loss rates as estimated on the basis of complete regrading out of storage, labor requirements, and direct cash costs as reported in 1946-47, were adjusted for 1935-39 cost-price conditions (Table 12).[9] Even at higher loss rates, costs and offsetting price increases are reduced considerably under conditions existing during the 1935-39 period, mainly because of lower labor costs and the lower value of losses. A price increase of 16.5 cents per crate over the average 1935-39 fall fresh sales price of 54 cents would have been sufficient to cover storage costs, including losses. However, a seasonal increase in price of approximately 31 per cent over the fresh sales price is required under 1935-39 conditions as compared to a 25 per cent seasonal increase in price in 1946-47.

TABLE 12. Price Increase Necessary to Offset Sweet Potato Storage Costs Under 1935-39 Conditions

Size of storage	Labor and direct costs*	Interest and depreciation†	Storage losses‡	Total price increase necessary§
	(Cents per crate)			
Large	1.0	1.2	13.5	15.7
Medium	1.4	2.1	13.5	17.0
Small	1.9	2.9	13.5	18.3
Average, all storages	1.3	1.7	13.5	16.5

* Computed on farm wage rate of 10 cents per hour (1935-39 average). Costs of material adjusted for index of prices paid by farmers in 1935-39.

† Varies according to value, age of storage, and length of life.

‡ Losses figured at 54 cents per crate (1935-39 Oct.-Nov. average price).

§ Prices per bushel as reported in published statistics have been adjusted to a 50-pound crate basis. Losses were figured at a rate of 20 per cent based on the grading and repacking of all stored sweet potatoes to sell as No. 1's and No. 2's.

Financial Results from Storing Sweet Potatoes on the Farm

1946 and 1947 Crops

Farm storage of sweet potatoes proved unprofitable during the 1946-47 season, but was profitable in 1947-48 (Table 13). In the former season losses averaged 44.1 cents per crate stored, mainly because of the failure of prices to rise as anticipated during the marketing season. The average price received by storage owners for fresh sales in the fall of 1946 was $1.35 per crate (Table 14). The bulk of the sweet potatoes sold fresh were unclassified as to grade for which a price of $1.37 per crate was

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[9] A loss rate based on total regrading is used since selling by farmers on an unclassified grade basis is a relatively recent practice which will probably be done to a lesser extent in the future.

TABLE 13. Results of Storing Sweet Potatoes in Farm Storages, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

	1946-47	1947-48
	All storages	
Marketable sweet potatoes stored (Crates)	111,996	57,559
Value*	$151,195	$ 76,533
Sweet potatoes actually salable (Crates)†	94,538	53,174
Value	$107,503	$ 86,674
Gross gain or loss	-$ 43,692	$ 10,121
Cost of storing (excluding losses)‡		
Cents per crate	5.1	5.2
Total cost	$ 5,712	$ 2,993
Total net gain or loss	-$ 49,404	$ 7,128
Net gain or loss in cents per crate stored	-44.1	13.4

* Based on average price received for fresh sales in the fall.

† Amount actually received for salable sweet potatoes. Salable sweet potatoes equal those originally placed in storage minus losses.

‡ Shrinkage and decay losses reflected in gross losses.

received. The small amounts of No. 1's and No. 2's brought $1.63 and $0.40, respectively. In comparison, the price received for stored sweet potatoes in the spring of 1947 averaged only $1.14 per crate. A large proportion of these sales were No. 1 grade.

The large volume of sales in the weevil quarantine area during April 1947 to meet the May 1 deadline probably resulted in higher losses than would otherwise have been sustained. Not all farm storage owners realized losses, although the majority did. The larger operators incurred the greatest losses per crate stored. They sold on a regraded basis to a greater extent and held their sweet potatoes in storage longer than did medium and small storage owners. Consequently, deterioration in quality was greater and more sweet potatoes were sold at the lower prices that prevailed in April.

In the 1947-48 season, the average net gain on sweet potatoes stored amounted to 13.4 cents per crate. Price increases from fall until late winter and spring were sufficient to more than offset storage costs, including losses, by this amount. The average price received for fresh sales in the fall was $1.33, but the price in the spring of 1948 averaged $1.63, an increase of 30 cents per crate.

Since total farm holdings are relatively small compared with fresh sales and commercial storage holdings, it is not likely that the fresh price would be affected to any appreciable extent if all of the marketable crop were placed in the hands of dealers and commercial storage operators in the fall. The fact that the farm storage owner has an alternative of holding his crop instead of selling at digging time tends to put him in a better bargaining position when making fresh sales in the fall.

Seasonal Price Patterns and Probable Results From Storing Over A Period of Years

The character of the seasonal movement of sweet potato prices explains why an advantage can be gained by storing in many years. Price movements during the marketing season are closely related to changes

TABLE 14. Grades and Prices of Fresh and Stored Sweet Potatoes Sold by Farm Storage Owners, Opelousas-Sunset Area, 1946-47 and 1947-48 Seasons

Grade	1946-47				1947-48			
	Fresh Sales		Stored Sales		Fresh Sales		Stored Sales	
	Crates sold	Average price received	Crates sold	Average price received	Crates sold	Average price received	Crates sold	Average price received
No. 1	4,248	$1.63	52,744*	$1.35	2,580	$2.51†	7,039	$2.42
No. 2	1,600	.40	16,357	.42	870	.73	4,665	.87
Unclassified	32,809	1.37	25,437	1.16	40,177	1.27	41,470	1.58
Field run	575	1.14	—	—	—	—	—	—
Total all grades	39,232	$1.35	94,538	$1.14	43,627	$1.33	53,174	$1.63

* Does not include sales of one storage owner who was also a trucker.

† Includes 1,080 crates of No. 1 grade sweet potatoes sold in August and early September at premium prices. Sales later in the season brought lower prices.

in the volume of sweet potatoes marketed. For instance, lowest prices are received in November when marketings are greatest (Figure 1). After November the bulk of the crop has been marketed by farmers, and commercial storage holdings are moved into trade channels during the winter and spring months. As market supplies of sweet potatoes become smaller after November, the price usually increases seasonally until a peak is reached in July and early August when old supplies are depleted and scattered early sales from the new crop bring premium prices.

The seasonal price increase has been expressed in terms of percentages of the October-November average price in Figure 2. During the 11-year period 1935-45 prices rose 52 per cent from the October-November average to June, or an average of approximately 7 per cent per month. The greatest increase occurred after January.

In order to compare storage costs with seasonal price increases, costs reported in the period studied were adjusted for conditions existing in each year of the 1935-45 period (Table 15). That is, labor and direct cash costs were charged at the prevailing wage rate and prices paid by farmers. Storage and regrading losses were calculated at 20 per cent and were valued at each year's fresh sales price. Computed on this

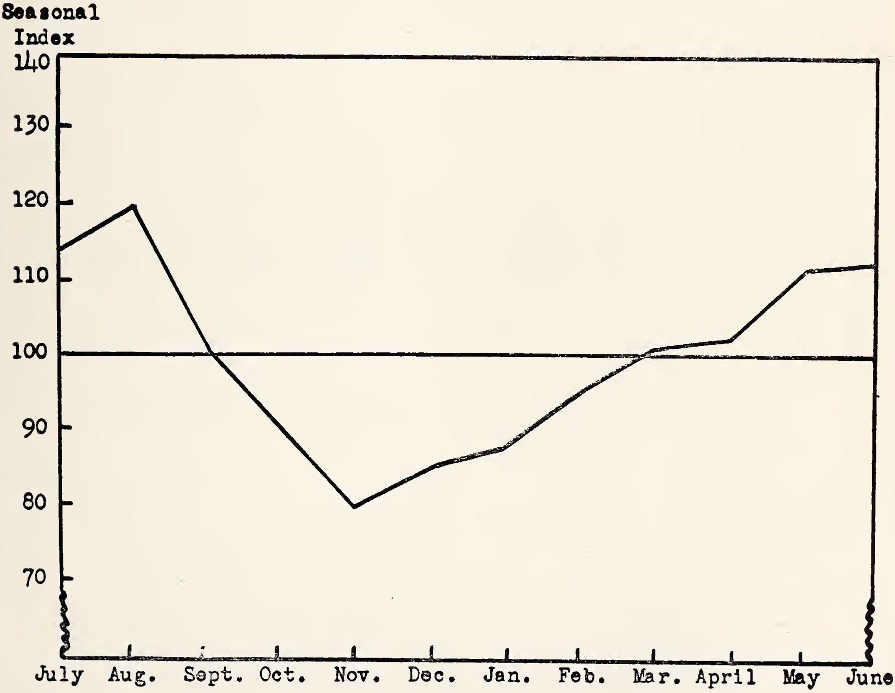

Fig. 1 — Seasonal Index of Prices Received by Louisiana Farmers for Sweet Potatoes, 1930-45. (Season average price equals 100 per cent)

The farm price of sweet potatoes usually is highest in the summer months when the old crop is about gone and the new crop is beginning to come on the market. Prices reach a low point in November when movement is heaviest, then increase until the following summer. Seasonal price changes from year to year are not uniform.

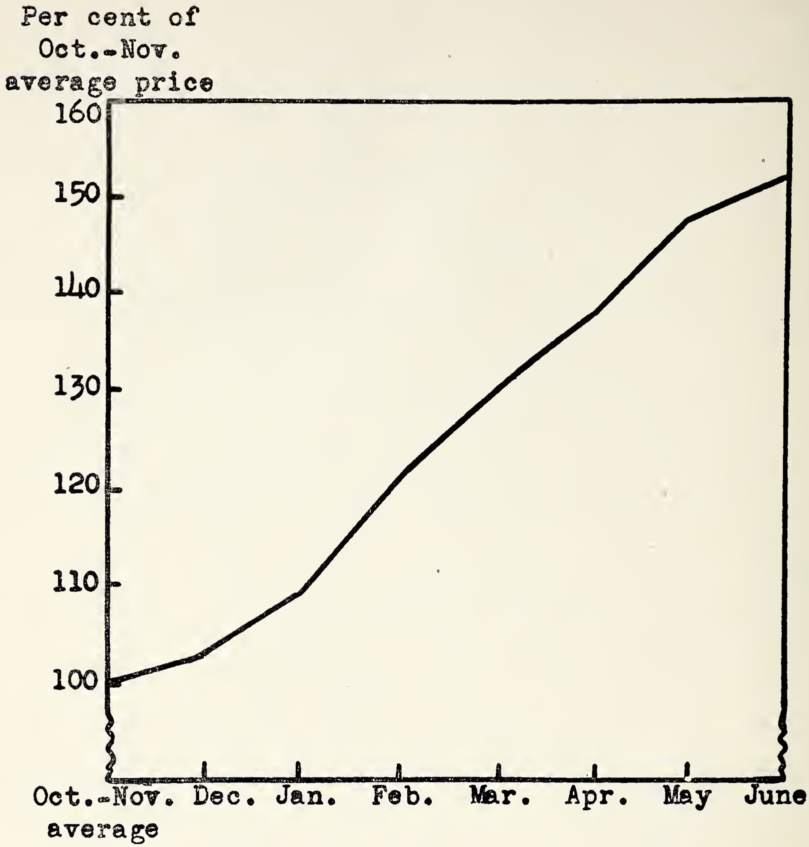

FIG. 2—Average Seasonal Increase in Farm Price of Louisiana Sweet Potatoes, 1935-45. (Oct.-Nov. average weighted price equals 100 per cent)

June prices averaged 52 per cent higher than October-November prices during the 11-year period. Monthly increases averaged 7 per cent, but varied greatly from year to year.

basis, average storage costs over the period were about 23 cents per crate. Since the average fresh sales price was 78 cents per crate, $1.01 per crate had to be received for stored sales to offset costs. Expressed in terms of percentages, the stored price had to be 29 per cent higher, or 129 per cent of the fresh sales price. These figures represent an average period of storage of nearly 5 months. Thus, they should be compared with March and April prices. Storers who sell earlier have somewhat lower costs while those who hold their sweet potatoes until May or June have higher costs and losses. However, much of the labor costs and losses are incurred whether or not the period of storage is short or long.

Considering the average of all years from 1935-45, a price sufficiently high to offset costs was paid in March (Table 16). However, when considering individual years, in only 4 of the 11 years were prices high

TABLE 15. Price Increase Necessary to Offset Costs and Losses Incurred in Storing Sweet Potatoes in Farm Storages Under 1935-45 Conditions*

Crop year	Oct.-Nov. average weighted price	Price increase necessary to offset costs	Stored sales price necessary to offset costs	Per cent stored sales price was of Oct.-Nov. price
	(Cents per crate)			
1935	47	15	62	132
1936	73	21	94	129
1937	56	17	73	130
1938	47	15	62	132
1939	47	15	62	132
1940	62	19	81	131
1941	57	17	77	135
1942	82	24	106	129
1943	152	42	195	128
1944	116	34	150	129
1945	115	34	149	130
11-year average	78	23	101	129

* Prices per bushel as reported in published statistics have been adjusted to a 50-pound crate basis.

† Storage costs are based on 1946-47 labor and material rates applied to price and wage levels of the respective years. Losses were computed at a rate of 20 per cent, based on the regrading of all sweet potatoes to sell as No. 1's and No. 2's. No value was given culls, although in some instances they had limited feeding value.

enough in March to offset costs, while April prices were sufficiently high in 6 years. The relatively large average March price increase over the period was influenced by the high prices received in March of 1944 and 1945. Prices had increased sufficiently by May to cover even considerably higher costs in 7 years while the June price covered costs in 9 of the 11 years. This analysis indicates that for storing to have been profitable for the majority of storers over the 11-year period, sweet potatoes had to be held on the average until March or April. This does not mean that individual storers cannot receive favorable prices during earlier months in most years. It does mean, however, that under 1935-45 conditions, costs of storing will not be offset by an increased price until March or April in the majority of years. It is entirely possible in the future that increased farm holdings, together with large commercial holdings which may have to be moved in a shorter marketing season, will tend to reduce the seasonal price increase from that experienced in the past. Under such conditions, the value of a farm storage to the individual grower would then be through a better bargaining position to gain an advantageous overall price for his entire crop. Because of the economics of large storages and the considerable expense to erect individual small storage houses, the advantages that may lie in cooperative storing by a group of growers should not be overlooked.

There is always an element of risk in storing which should be considered. Some growers who built storage houses because of the favorable results from storing realized by others in 1944 and 1945, declared they would not risk holding sweet potatoes in storage again following their losses in 1946-47. It should be emphasized that before investing in an expensive storage house and holding sweet potatoes on the farm, growers should be financially prepared to stand heavy losses in some years.

TABLE 16. Probable Results from Storing Sweet Potatoes in Farm Storages During 1935-45 Period

Crop year	Per cent of Oct.-Nov. average price, stored sales price must have been to cover storage costs	Per cent actual price received was of October-November average price						
		December	January	February	March	April	May	June
1935	132	96	106	106	106	115	135*	144
1936	129	94	100	106	119	138*	138	125
1937	130	105	105	113	121	113	129	137*
1938	132	106	106	125	125	135*	154	154
1939	132	106	106	135*	144	144	144	163
1940	131	103	103	118	118	125	125	132*
1941	135	103	111	119	119	119	119	127
1942	129	111	111	128	178*	183	200	200
1943	128	90	93	99	108	114	126	132*
1944	129	105	121	133*	137	137	156	156
1945	130	126	126	150*	165	173	185	193
11-year average	129	103	109	121	131	137	148	152

* Indicates month in which price became sufficiently high to make storage profitable.

Summary

During the past decade growers have held increasingly large quantities of sweet potatoes on the farm for sale in the winter and spring months, particularly in the Opelousas-Sunset area. However, the volume stored by farmers is still small compared to the amount sold when dug in the fall and commercial storage holdings by buyers and shippers.

The disposition of the crop in any particular year is determined to a great extent by the experiences of the previous season. In the 1946-47 season, the 59 farm storage owners studied stored 72 per cent of their marketable sweet potatoes, while selling 28 per cent at digging time. Because of unfavorable results from storing in 1946-47, only 48 per cent of the marketable crop of storage owners was stored in the 1947-48 season.

Local rail and truck shippers handle the better grades of both fresh and stored sweet potatoes in the Opelousas-Sunset area. Canneries and dehydrators provide an outlet for some sweet potatoes not suitable for shipping. Most sweet potatoes of poor quality are used for feed and home use. The farm storage owners studied dehydrated about 8 per cent of their crop for livestock feed in 1946-47 and nearly 14 per cent in 1947-48.

The storages studied in 1946-47 had an average capacity of 3,545 crates and cost an average of $464 when built. They were used to 77 per cent of capacity in 1946-47 and to 70 per cent in 1947-48. However, 5 storage owners of 31 contacted in the latter year did not store any sweet potatoes. The per cent of storage space utilized in 1947-48 would be considerably less if their total storage capacity were used in making calculations. Some growers used excess capacity above their own crop needs to store for other growers or for storing sweet potatoes purchased for resale. The investment in the storage house per crate of capacity decreased as the size of the storage increased, and operating costs per crate of sweet potatoes stored were lowest for large storages and highest for small storages.

The reported loss of sweet potatoes from shrinkage, decay, insect and rat damage, and regrading varied directly with the grade of sweet potatoes sold out of storage. In the 1946-47 season, farm storage owners reported a loss rate of 16.4 per cent, based on sales of 57.0 per cent of their sweet potatoes as No. 1 grade, 17.4 per cent as No. 2's., and 25.6 per cent unclassified as to grade. Sales of unclassified sweet potatoes usually were made on a crate-for-crate basis as originally placed in storage. In 1947-48, only 13.2 per cent of removals from storage were sold as No. 1's, while 78.0 per cent were sold as originally packed. Consequently, a loss rate of only 7.6 per cent was reported.

Buyers normally base their purchasing price for unclassified sweet potatoes on an estimate of the grades they will pack out. Based on packing shed operations, buyers estimated that normally sweet potatoes held in storage for a period of 4 to 6 months would grade out approximately 62 per cent No. 1's, 18 per cent No. 2's, and 20 per cent loss. At the prices received for different grades in the springs of 1947 and 1948, the farmer would have been better off by approximately 24 cents per crate by selling as unclassified in 1947 because of very low prices for No. 2's, but would have increased his receipts by about 9 cents per crate in 1948 by selling on a graded basis. Probably more sweet potatoes will be bought on a regraded basis in the future and prices paid growers will more accurately reflect the quality sold.

An increase of 31.6 cents per crate over the fresh sales price was required in 1946-47 to offset all costs of storing. Losses of sweet potatoes in storage were by far the most important cost item, amounting to 26.5 cents per crate sold. Labor and direct costs amounted to 3.4 cents per crate, while depreciation and interest averaged only 1.7 cents. Because of less regrading by the farm storage owner in 1947-48 and the resulting smaller physical losses of sweet potatoes, an increase in price of 10.9 cents per crate was needed to cover storage losses. Other costs were about the same as in 1946-47. Under price-cost conditions of the 1935-39 period, a price increase of 16.5 cents per crate, or 31 per cent, over the fall fresh sales price would have been sufficient to cover storage costs.

Farm storage of sweet potatoes proved unprofitable to most growers during 1946-47, mainly because of the failure of prices to rise seasonally. The fall price averaged $1.35 per crate for fresh sales while the winter and spring price for stored sales averaged only $1.14, resulting in a net loss, including storage costs, of 44 cents a crate. On the other hand, in 1947-48 a net gain of 13 cents a crate was realized on stored sweet potatoes.

From past results it appears that an advantage can be gained from storing because the average seasonal price increase over a period of years is sufficient to more than offset storage costs. But it is possible that in the future increased farm and commercial storage holdings will tend to reduce the price spread between fall and spring. However, the availability of farm storage facilities gives the individual grower more bargaining power in the disposal of his entire crop. Because of the economies of large storages and the expense of erecting small individual storage houses, the advantages that may lie in cooperatively-owned storages by groups of small growers should not be overlooked.

It should be emphasized that in 6 of the last 13 seasons farm storage has been unprofitable for many growers. There is such an element of risk in storing sweet potatoes that growers should be financially able to stand heavy losses in some years before investing their money in farm storage facilities.

TECHNOLOGY AND SCIENCE ROOM

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PREPACKAGING TREE-RIPENED

Louisiana Peaches

By
J. M. BAKER

TECHNOLOGY AND SCIENCE ROOM

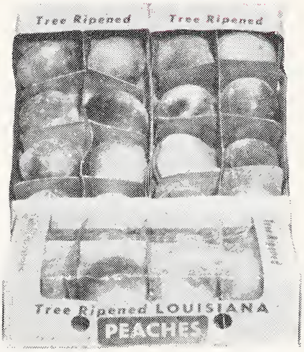

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TABLE OF CONTENTS

Page

Introduction 3

Cooperating Agencies 3

Objectives 4

Consumer Reaction to Tree-Ripened Peaches 4

Prepackaging the Peaches 5

Transporting Prepackaged Peaches 6

Consumer Preference 7

Package and Bulk Purchases at 30-Minute Intervals 10

Package Preference 10

Summary and Appraisals 11

Acknowledgments 12

* * *

COVER — Three types of containers used in prepackaging Louisiana peaches in the consumer preference tests. The cellophane-wrapped tray at the bottom right was the most popular as it provided the best view of the peaches.

PREPACKAGING TREE-RIPENED LOUISIANA PEACHES

By

J. M. Baker

Introduction

The Louisiana commercial peach crop in 1948 was about 35,000 bushels. The industry though small is growing rapidly and it may be expected that along with the growth in production will develop many marketing problems. Most of the peach area is situated within truck-transport range of a number of good markets. Some of the growers of this state are relatively new in the peach business and probably will need information that will help them to establish efficient marketing methods and practices. It was therefore with the purpose of helping to develop a sound and practical peach marketing program for the area that a series of over-all studies dealing with the movement of the peach crop from producer to consumer was started during the harvest season of 1946.

The research program thus far has been divided into two parts. One part has been confined to the problems of marketing peaches from the orchard to the retail food store and the other part as presented in this report has dealt with merchandising methods and consumer preferences in the store.[1] The studies conducted in the stores have been largely experimental and included such items as consumer reaction to peaches of different degrees of ripeness, demand and price differentials, prepackaging, and methods of merchandising. All operations connected with obtaining the desired information had the support and cooperation of other agencies interested in peach marketing.

Cooperating Agencies

A number of major services were contributed by the cooperating agencies. The Great Atlantic and Pacific Tea Company provided the retail store facilities and the peaches for store tests and prepackaging experiments; Container Corporation of America of Fort Worth, Texas, constructed the consumer-package containers; Bastrop Orchard Company of Bastrop, Louisiana, graded the peaches for store tests and prepackaged part of them in box-like containers for experiments; E. I. du Pont de Nemours & Company provided cellophane for wrapping consumer-package trays used also for testing purposes; and Wm. Wolf Bakery of Baton Rouge, Louisiana, wrapped the trays in a cake-wrapping machine.

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[1] The retail packaging and quality phase of peach marketing presented in this report was coordinated with the orchard and transportation phase of peach marketing carried on by D. C. Alderman of the Department of Horticultural Research.

Objectives

The study had six objectives: (1) to observe consumer reaction to tree-ripened peaches in the retail food store; (2) to determine range and average size of consumer purchases; (3) to compare the method of prepackaging peaches at the shipping point with prepackaging them at the destination; (4) to determine at differentials in price the difference between demand for prepackaged peaches and demand for peaches in the open bin; (5) to compare the merchandising merits of different sizes and types of consumer packages; and (6) to appraise the results of the study in terms of practical use by peach producers and retail food store operators.

Consumer Reactions to Tree-Ripened Peaches

The first observations of consumer reaction to tree-ripened peaches, which served as preliminary to later studies, were made in 1946 when the fruit from North Louisiana was displayed in a large retail food store. The peaches used during the early part of the season consisted of Golden Jubilee and the ones displayed later were of the Elberta variety. Customers expressed much satisfaction at being able to find tree-ripened peaches on the market, and the rapidity of purchases which followed indicated a greatly increased demand.

With the view to helping establish better merchandising practices along with better quality products, it was anticipated that a knowledge of the popular size of purchase, or the range in sizes, would be needed in pricing peaches at retail and in connection with any program of prepackaging. Therefore, while the full-ripe peaches were on display, 602 individual purchases were recorded with respect to the quantity taken at the different ranges in size and the average size of all individual purchases, as shown in Table 1. The average size of purchase of Golden Jubilee peaches was 2.3 pounds and that of the Elbertas was 2.4 pounds, and all subsequent checks closely approximate these findings.

TABLE 1. Size of Individual Purchases of Louisiana Golden Jubilee and Elberta Peaches at Selected Retail Food Store, New Orleans, Louisiana, July 1946

Size of Purchase in lbs.	Individual Purchases							
	Golden Jubilee				Elberta			
	No.	Per cent	Pounds	Per cent	No.	Per cent	Pounds	Per cent
Under 1.0	1	0.2	0.8	0.1	2	1.3	2.0	.5
1.0 - 1.9	146	32.4	193.6	18.8	37	24.3	49.3	13.3
2.0 - 2.9	156	34.7	301.3	29.2	64	42.1	137.0	35.9
3.0 - 3.9	99	22.0	318.2	30.9	29	19.1	93.8	25.3
4.0 - 4.9	31	6.9	128.2	12.4	14	9.2	56.8	15.3
5.0 - up	17	3.8	88.5	8.6	6	4.0	32.5	8.7
Total	450	100.0	1030.6	100.0	152	100.0	371.4	100.0
Average	—	—	2.3	—	—	—	2.4	—

During the succeeding year, 1947, some work was done in the retail food stores to compare the demand for full-ripe peaches with the demand for green-ripe peaches. The green-ripes, of course, comprise the kind usually found on display. For a comparative test the full-ripe peaches were packed in eight-peach, cellophane-wrapped trays, priced at 13 cents a pound, and placed by the side of green-ripe peaches displayed in both cellophane bags and the open bin and priced at 10 cents. With this choice before them consumers indicated their preference by purchasing four times as many pounds of the full-ripe peaches as they did of the green-ripes. The results of the test were convincing enough to eliminate the green-ripe peaches from competition with the full-ripes in future retail store studies.

While working with the 1948 peach crop some observations were made in a selected food store in Bossier City, Louisiana, with respect to consumer reaction to early tree-ripened peaches and the methods of retailing them. As the peaches were too small for the box-like containers at hand no consumer preference studies such as the ones planned could be conducted. A substitute test was provided by placing alongside the loose peaches in open-bin some of the same kind of peaches in cellophane bags. The test was of too short duration to obtain enough comparable data for publication, but it was clearly indicated that consumer preference was for the prepared package. The consumers could inspect the product through the transparent walls of the package and make the purchase with much ease. Few of the bulk peaches were taken while the cellophane bags were available. Even though the bag was preferable to the open-bin it still lacked the qualities needed in retailing peaches at the full-ripe stage.

Prepackaging the Peaches

The store studies required two displays of tree-ripened peaches, one to consist of consumer packages and the other bulk peaches in the open-bin. With the needed supply assembled at Bastrop the major task in the preparatory work was to put part of the peaches in suitable types of package containers.

As the studies were "producer to consumer" operations the question arose as to the most advantageous place, especially from the standpoint of the producer, to prepackage peaches for retail store use. It was known that peaches could be prepackaged successfully at the consumer end of the line, but it was a question as to whether or not tree-ripened peaches could be packaged at the farm in North Louisiana and transported 400 miles in a refrigerated truck to the stores in Baton Rouge and New Orleans and arrive in acceptable condition.

It was realized that if this could be done the amount of time and handling ordinarily needed in prepackaging peaches at the destination would be greatly reduced. And not only would the marketing processes be facilitated but the producers through proper organization and good management could perform some of the "middleman" services and get paid for them. As these studies move along one thing should be kept constantly in mind, and that is how to make the marketing of Louisiana peaches more efficient and at the same time net producers a larger share of the consumer dollar.

As there was no tray wrapping equipment at the shipping point to prepackage a portion of the test peaches, it was necessary to use cellophane-windowed box containers. The boxes were obtained from the cooperating container company in two different sizes to hold eight peaches and six peaches, respectively. Since the larger package conformed more closely to the size preferred by consumers, the major part of the supply consisted of that type. For the prepackaging at the point of destination an eight-peach tray wrapped in cellophane was used, the wrapping being done by the selected Baton Rouge bakery.

Transporting Prepackaged Peaches

After a certain portion of the test peaches had been prepackaged at the orchard loading shed, the packages were placed in cardboard master containers for truck transport to the selected retail food store. The container with dimensions of 15" by 20" by 8½" accommodates 18 eight-peach packages fitted in three layers separated by cardboard flats.[1] A picture of a master container ready for shipment is presented in Figure 1.

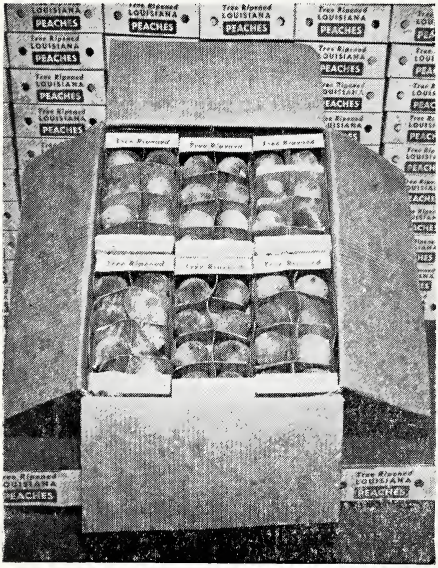

Fig. 1—Master Container Filled with 18 of the Wide, Cellophane-Windowed Packages.

Five different deliveries of the prepackaged fruit were made to the store in Baton Rouge where the tests were conducted. The first three and last of the lots were from Bastrop, and the fourth comprised the peaches prepackaged by the local bakery. Dates of arrival, the quantity of peaches in each lot and the amount of losses in transit are shown in Table 2.

The data indicate that the peaches arrived at the retail store in highly satisfactory condition with an average loss of five-tenths of one per cent, or only one peach out of every 189. The general quality of the fruit was unusually well preserved, and most of the deliveries

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[1] Dr. D. C. Alderman of the L. S. U. Horticultural Research Department arranged for the containers and supervised the prepackaging of the peaches at the orchard shed.

TABLE 2. Losses in the Prepackaged Peaches from Farm Packing Shed to Retail Food Store in Baton Rouge during July 1948

Delivery July date	Consumer Packages (2-lb.)	Number of Peaches	Peaches not Salable	Losses in Per cent
12	144	1,152	8	0.7
14	270	2,160	17	0.8
22	640	5,120	22	0.4
24*	540	4,320	24	0.6
26	108	864	1	0.1
Total	1,702	13,616	72	——
Per cent	——	——	——	0.5

*This delivery consisted of peaches prepackaged at the Baton Rouge bakery.

with respect to ripeness were ready for immediate retail use. In some cases, however, the packages were excessively moist and the cellophane somewhat cloudy, but these conditions soon disappeared after unpacking. Probably much of the dampness could have been prevented by having the shipping containers better ventilated. On the whole, the experiment in prepackaging peaches at the shipping point thus far can be rated as successful and worthy of extended study, or even practical use in marketing tree-ripened fruit.

It was desirable while conducting the different tests to make comparisons between the amount of spoilage in bulk peaches and prepackaged peaches both in transit and on the retail store counter, but under prevailing conditions sufficient data could not be assembled for a satisfactory report. Therefore, this assignment may be extended to future studies.

Consumer Preference

Of the 1,702 consumer packages of tree-ripened Elberta peaches received at the selected retail food store in Baton Rouge and observed for consumer reaction, 714 packages were placed by the side of bulk peaches of the same, or near the same, quality as the ones in the packages to compete for consumer patronage. Competitive displays were arranged on four different days during the peach harvesting season, as shown in Table 3, where information on the relative number and amount of the different kinds of purchases is also given. In all tests except the one conducted July 27, the packaged peaches were priced at two pounds for 29 cents and the bulk peaches at two pounds for 27 cents. In the July 27 test the same units of packaged and bulk peaches were quoted at 27 cents and 25 cents, respectively. The different types of consumer packages put on display are shown by illustration on the cover.

In conducting the tests for consumer preference between packaged and bulk peaches some difficulty was encountered in obtaining comparable data. The open bin as a factor changed in appearance and quality of product with each succeeding purchase or the addition of replace-

TABLE 3. Difference between Consumer Demand for Prepackaged and Bulk Tree-Ripened Louisiana Peaches in Selected Retail Food Stores in Baton Rouge and New Orleans, Louisiana, July 1948*

July Sales Date	Number Packages Purchased	Number and Amount of Peach Purchases								
		Package Purchases		Bulk Purchases		Total Purchases		Per cent of Volume		
		Number	Pounds	Number	Pounds	Number	Pounds	Packages	Bulk	Total
17	286	263	572.0	102	244.8	365	816.8	70.0	30.0	100.0
23	95	80	184.5	64	153.6	144	338.1	54.6	45.4	100.0
24	266	236	532.0	185	444.0	421	976.0	54.5	45.5	100.0
27	67	56	134.0	38	91.2	94	225.2	59.5	40.5	100.0
Total	714	635	1422.5	389	933.6	1024	2356.1	—	—	—
Per cent	—	—	—	—	—	—	—	60.4	39.6	100.0

*During the first three tests packaged peaches were priced at 29 cents for two pounds and the bulk at 27 cents for two pounds. In the last test the prices were 27 cents and 25 cents, respectively.

ments. Moreover, throughout the shopping hours each customer entering the store was called upon to choose between consumer packages, something new in the method of merchandising, and the old open bin with which she was thoroughly familiar. It is believed that these and other obstacles were satisfactorily overcome by constant care and effort to preserve the important competitive features of each display, by repeated tests of the same pattern, and by compiling only the data obtained under acceptable conditions. There was a tabulation of the number of each kind of purchase every 15 minutes throughout the periods of comparison.

As shown in the table, during the four different tests consumers made 635 purchases of packaged peaches which amounted in weight to 1,422.5 pounds, while the purchases of bulk peaches numbered 389 and totaled 933.6 pounds. The final tabulation shows that of the total quantity of peaches purchased, 60.4 per cent was in packages and 39.6 per cent was bulk peaches from the open bin. The exceptionally wide difference between the packaged and bulk peach purchases in the first test, as of July 17, may be attributed to the fact that even though the peaches in the bulk display were of excellent quality they were not so good as the ones in packages. All peaches used in the other three tests, both in packages and bulk, were on the whole of equal quality. As the study progressed consumers appeared to receive the packaged peaches with increased interest.

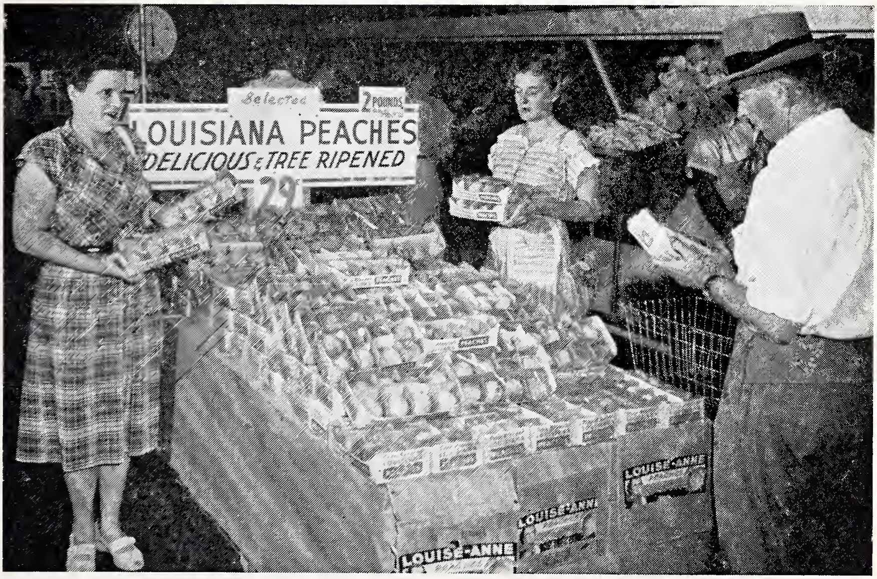
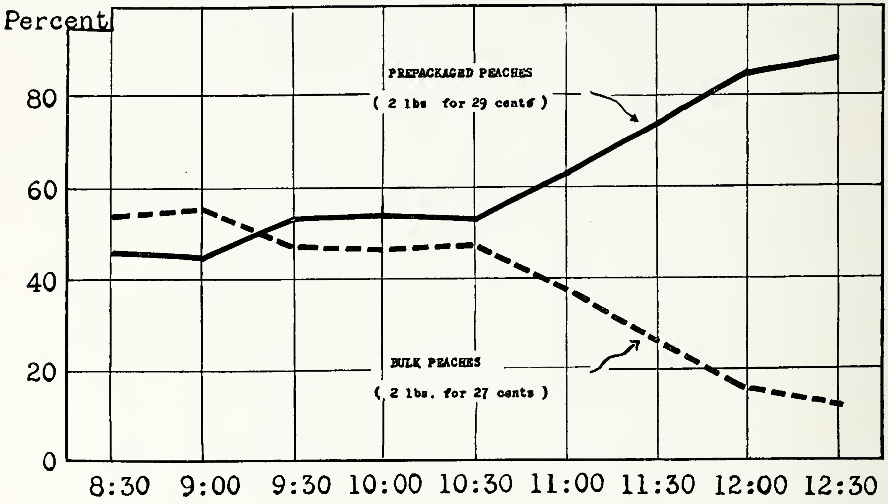


Fig. 2—View of Consumers Purchasing Prepackaged Peaches in a Large Retail Food Store in Baton Rouge.

Package and Bulk Purchases at 30-Minute Intervals

A comparison between the quantity of peaches purchased from the consumer package display and the amount of peaches taken in bulk from the open bin was calculated for each succeeding 30 minutes during active four-hour shopping periods. The results are charted in Figure 3. And as observed, during the first two periods when the bulk display was at its best in appearance and quality the bulk purchases exceeded the purchases of packaged peaches, with the record of 54.5 per cent and 45.5 per cent, respectively. But as the open bin display deteriorated from customers' continually picking out the best peaches, and also from excessive handling, the preference changed in favor of the packages, with a marked increase in the difference in demand.



Thirty-minute periods ending as indicated

FIG. 3—Difference in Per Cent of Prepackaged and Bulk Tree-Ripened Louisiana Peaches Purchased Progressively by Consumers at Selected Food Store during Four-Hour Periods, Baton Rouge, July 1948.

Package Preference

During both peach marketing seasons, 1947 and 1948, short but conclusive tests were conducted to establish consumer preference for size of package. Cellophane-wrapped trays containing eight peaches were displayed by the side of the same kind of packages containing six peaches. The results of the tests, given in Table 4, indicate a decided consumer preference for the larger package over the smaller in the ratio of about six to four. An accompanying factor which also would help to eliminate the six-peach container in the comparison is the fact that it costs almost as much as the eight-peach container.

TABLE 4. Difference in Consumer Demand Between Packages Containing Eight Peaches and Packages Containing Six Peaches at Selected Food Store in Baton Rouge, Louisiana, July 1947 and July 1948*

July of Year	Number of Packages and Amount of Peaches Purchased								
	8-Peach Packages		6-Peach Packages		Total Packages		Per cent of Pounds		
	Number	Pounds	Number	Pounds	Number	Pounds	8-peach	6-peach	Total
1947	309	618.0	264	462.0	571	1,080.0	57.2	42.8	100.0
1948	73	146.0	22	38.5	95	184.5	79.1	20.9	100.0
Total	382	764.0	286	500.5	666	1,264.5	—	—	—
Per cent	—	—	—	—	—	—	60.4	39.6	100.0

*Average weight of 6-peach package was 1.75 pounds and of 8-peach package 2.00 pounds.

In reference to choices in the type of package, it was evident that the package providing the largest amount of window space through which consumers could carefully inspect the peaches was preferable.

Summary and Appraisals

1. Consumers in the retail store reacted favorably to what in many instances was their first opportunity to purchase tree-ripened peaches ready for table use. The average size purchases of the two different varieties displayed, Golden Jubilees and Elbertas, were 2.3 pounds and 2.4 pounds, respectively, or an average of eight peaches each.

2. With full-ripe peaches priced at 13 cents a pound and green-ripes at 10 cents, consumers in the store showed a preference of four to one for the full-ripes over the green-ripes.

3. By experiment it was shown that tree-ripened peaches can be prepackaged at the orchard shed in northern Louisiana and delivered to the retail stores of Baton Rouge and New Orleans in satisfactory condition for immediate store use. The loss for five different deliveries totaling 3,404 pounds was 18 pounds, which was an average loss of five-tenths of one per cent, or one peach out of every 189.

4. From competitive tests in the retail food store between peaches in consumer packages and peaches displayed in the open bin, with the packaged fruit priced at one cent a pound higher than the bulk peach price, consumers indicated their preference by purchasing three pounds of the packaged peaches to every two pounds of peaches taken from the open bin.

5. The results from tests between eight-peach and six-peach packages reveal a decided consumer preference for the larger size.

Some of the favorable points registered for prepackaged peaches by retail store customers included (1) the use of good quality peaches for consumer packages; (2) uniform quality in the pack; (3) time saved in shopping; (4) ease of handling package; (5) better sanitation in prepackaging over open bin operation; (6) all consumers get same quality of peaches at the same price; (7) peaches are protected from injury on way home; and (8) peaches in the consumer package keep better and retain their good flavor longer in the home refrigerator than do loose peaches.

Store operators were favorably impressed with prepackaging because it (1) makes handling of the peaches easier; (2) maintains uniform quality in display; (3) reduces loss in counter retailing; (4) helps customers shop faster and eliminates congestion at the peach bin; and (5) is consistent with improved merchandising practices.

In conclusion it should be emphasized that all the studies to date indicate that customers in the retail food store not only prefer peaches that are full ripe and contain the tree-ripened flavor but that they will purchase more in the long run and pay a higher price for peaches of these qualities; that prepackaging peaches for store use is practical and desirable, and if done at the shipping point will contribute to economy in marketing and afford additional benefits to producers or others who perform the prepackaging services.

Acknowledgments

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LOUISIANA BULLETIN NO. 435 OCTOBER 1948

Dairy Farming in the North Louisiana Upland Cotton Area

Organization, Costs, and Returns

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TABLE OF CONTENTS

Page

I INTRODUCTION 3

II ORGANIZATION OF FARMS STUDIED 5

- Land Use 5
- Farm Capital Investment 6
- Livestock Organization 7
- Labor Force 7
- Farm Receipts 8
- Farm Expenses 9
- Farm Returns 10
  - Variation in Returns 10

III THE DAIRY ENTERPRISE 11

- Production and Disposition of Milk 12
- The Cost of Producing Milk 13
  - Feed Costs 13
  - Labor, Power, and Equipment Costs 14
  - Pasture Costs 15
  - Other Costs 15
  - Summary of Costs of Producing Milk 16
- Enterprise Returns 16
  - Receipts from the Dairy Enterprise 16
  - Milk Receipts 17
  - Other Receipts 17
  - Summary of Returns 18
- Feeding Practices 18
  - Kind and Amount of Feed Used 18
  - Feeding According to Individual Production 19
  - Concentrate—Roughage Ratio 20
  - Milk—Concentrate Ratio 20
  - Summary on Feeding Practices 21

IV ANALYSIS OF THE DAIRY BUSINESS 22

- Size of Farm and Its Relationship to Costs and Returns 22
  - Relation of the Number of Cows in the Herd to Costs and Returns 22
  - Relation of the Number of Cows Milked to Costs and Returns 24
- Feeding Efficiency and Its Relationship to Costs and Returns 25
- Labor Efficiency and Its Relationship to Costs and Returns 27
- Production Rates and Their Relationship to Costs and Returns 28

V SUMMARY 30

Dairy Farming in the North Louisiana Upland Cotton Area

Organization, Costs, and Returns

By Frank D. Barlow, Jr., and Morris L. McGough[1]

INTRODUCTION

Dairy farms in the North Louisiana Upland Cotton Area are concentrated in two fairly distinct localities. The Shreveport milkshed comprises the upland areas of Caddo and DeSoto Parishes and a fairly concentrated area in the western part of Claiborne Parish. The Monroe milkshed embraces the eastern part of the North Louisiana Upland Cotton Area, and dairy farms are fairly well scattered throughout Lincoln, Jackson, and Ouachita Parishes.[2]

For several years the agricultural pattern of the Upland Cotton Area has been undergoing a significant transition from a one-crop system to various alternative enterprises. In the general search for profitable alternatives to cotton many farmers have considered dairying as an enterprise that would fit into existing farming systems and provide a profitable use of resources.

In order to have a more reliable basis for appraising the long-run potentialities of dairying as well as the success of those farmers who are already in the dairy business, an analysis was made of dairy farming in the North Louisiana Upland Cotton Area (Figure 1). The Louisiana Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics made a survey of dairy farms in the spring of 1947 in which the following aspects were covered:

(1) Complete record of the farm business.

(2) Record of the dairy enterprise.

(3) The supply, demand, utilization and distribution of milk.

Complete records were obtained on 54 dairy farms in Jackson, Lincoln, Claiborne, Caddo, and DeSoto Parishes of the North Louisiana Upland Cotton Area for the year 1946. These farms sold the bulk of their milk wholesale to the creameries in Monroe and Shreveport.

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[1] Mr. Morris L. McGough was formerly with the Louisiana Agricultural Experiment Station. He is now a member of the staff of Doane Agricultural Service, St. Louis, Missouri.

[2] In the last few years because of the increasing demand for milk and milk products quite a few farmers in the Mississippi River Delta Cotton Area have gone into the dairy business and the general area has been enlarged considerably.

Dairy farms were stratified as to size and a random sample

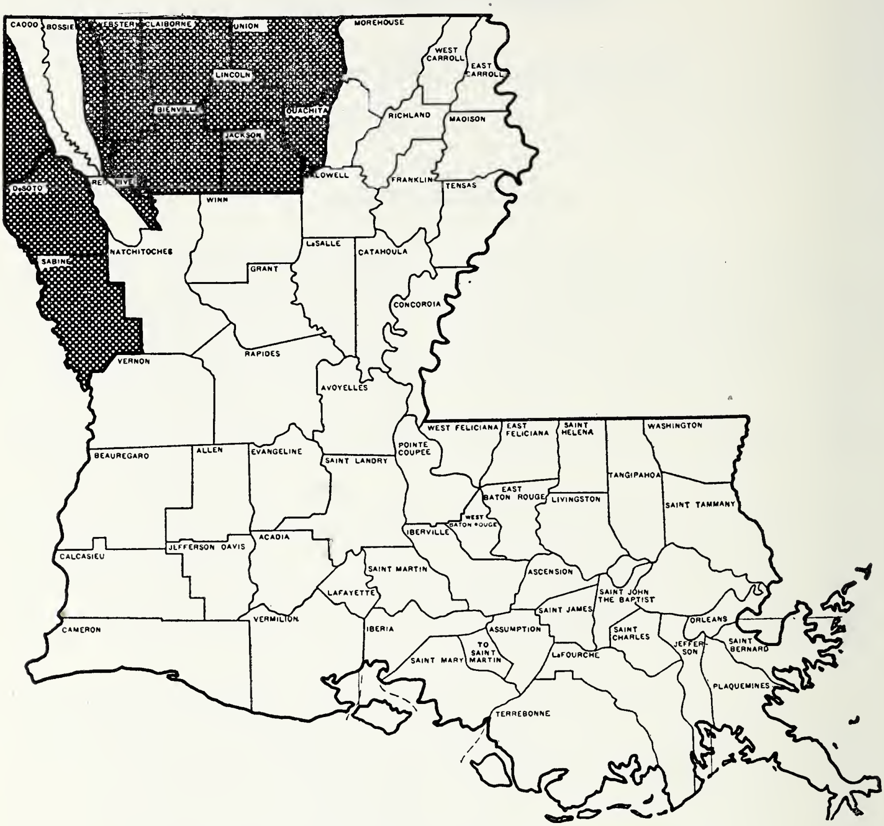

Fig 1.—Location of the North Louisiana Upland Cotton Area.

was taken within each size group. The dairy farms were considered to be representative of the area and typical size groups of dairy farms in the area. The survey method was employed in obtaining information on the organization of the farms, the dairy enterprise, labor, and feeding practices. In most cases data pertaining to receipts and expenses were taken directly from farm records. The data on the amount of milk sold, prices received, government subsidy, and butterfat content were obtained from the local creameries. Producer-distributors, farmers who retailed their own milk, were excluded from the sample. Only a few of the farmers interviewed were selling any milk at retail, and in all cases this quantity was small.

It is the purpose of this bulletin to present the analysis of the dairy farm business and the dairy enterprise.[3] The results obtained from this analysis should be of material value to dairy farmers in the area in improving their farm organization and achieving economy in milk production. The results also shed considerable light on the present returns to dairy farmers, the things that are essential for success, and in general they provide the basis for appraising the future possibilities for success. The results should also be of use to farmers who plan to shift to dairying as a major enterprise on their farms.

ORGANIZATION OF FARMS STUDIED

The dairy enterprise was the major source of income on all farms included in this study. However, crop production, principally cotton, was of considerable importance on some farms. Crop yields, including both cotton and feed crops, were very low. This was due in large part to the low natural fertility of the soil and to the poor cultural practices followed.

Considerable opportunity exists for the economical production of forage on individual farms, but farmers have made little effort to produce feed on the farm. Enterprise studies in the area have shown that through the use of improved fertilization and cultural practices farmers can produce roughages to a much greater advantage than grains, and therefore should concentrate in the production of forage. Soils in the area respond well to the application of commercial fertilizers.

Much remains to be done in the improvement of pastures. Pasture improvement provides a means of reducing the current excessive feed costs and is generally conceded to be the best means of achieving lower dairy production costs.

Land Use

The average size of farm was 322 acres, of which 71 acres were classified as cropland (Table 1). *Permanent pasture, plowable and improved,* averaged 50 acres per farm, or 15 per cent of the total farm acreage. *Permanent pasture, plowable but unimproved,* averaged 115 acres per farm, or 35 per cent of the total farm acreage. *Woodland pasture* averaged 75 acres per farm, or 22 per cent of the total farm acreage.

Most of the land operated on these farms was devoted to the dairy enterprise, with 240 acres, or 72 per cent of the total acreage, being utilized for pastures.

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[3] The marketing phases of the work are presented in a separate report by W. H. Alexander, "Milk Marketing in the North Louisiana Upland Cotton Area," Department of Agricultural Economics, Louisiana State University.

TABLE 1. Land Use, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Land use	Acres			
	Owned	Rented in	Rented out	Operated
Average per farm:				
Tilled cropland	34	4	3	35
Idle cropland	34	2	—	36
Total cropland	68	6	3	71
Permanent pasture, plowable improved	47	3	—	50
Permanent pasture, plowable unimproved	75	41	1	115
Woodland pasture	49	26	—	75
Woodland and waste	14	5	—	19
Farmstead	2	—	—	2
Total acreage	255	81	4	332

Farm Capital Investment

The average capital investment was $19,894 (Table 2). Slightly over one-half of the total investment was in land and buildings. The estimated value of real estate owned was $41 an acre. The investment in livestock, which was primarily dairy cattle, averaged $7,152 per farm, or 36 per cent of the total farm capital. This indicates the important position of the dairy enterprise in the capital organization of dairy farms. Dairy equipment made up 3 per cent of the total investment, other machinery and equipment 6 per cent, and feed and supplies 3 per cent. The average capital investment was $375 per cow on the farms included in this study.

TABLE 2. Distribution of Capital, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Farm capital	
	Dollars	Per cent of total
Average per farm:		
Dairy animals	6,725	34
Other livestock	427	2
Total livestock	7,152	36
Land	5,894	30
Buildings	4,510	22
Total real estate	10,404	52
Dairy equipment	636	3
Other machinery and equipment	1,230	6
Feed and supplies	472	3
Total farm capital	19,894	100

Livestock Organization

There was an average of 53 dairy cows per farm on the farms studied in 1946 (Table 3). During the year the average herd increased from 50 cows per farm on January 1, 1946, to 57 cows per farm on December 31, 1946, indicating an expansion of the dairy enterprise during the year. Other livestock including horses, mules, beef cattle, hogs, and chickens were of minor importance.

TABLE 3. Livestock Organization, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Type of livestock	January 1, 1946	December 31, 1946	Average for the year
Average per farm:	*Number*	*Number*	*Number*
Dairy cows, over 2 years	50	57	53
Dairy heifers, 1-2 years	7	11	9
Dairy calves	11	11	11
Bulls	2	2	2
Other cows, over 2 years	1	1	1
Other calves	—	—	—
Workstock	2	2	2
Other horses and colts	1	1	1
Brood sows	—	1	1
Boars	—	—	—
Other hogs and pigs	1	2	2
Poultry	49	49	49

Labor Force

Dairy farmers worked the equivalent of 8 months[4] during the year (Table 4). The farmers' families worked the equivalent of 4 months during 1946, while cropper labor accounted for the equival-

TABLE 4. Labor Force, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	All farms
Months of labor:	
Operator	8
Family	4
Cropper	4
Hired	16
Total	32
Man equivalent	2.7
Productive man work units:	
Crops	180
Livestock	430
Other receipts	27
Total	637
Productive man work units per man	236

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[4] A month was considered as 25 days.

ent of 4 months of work. Hired labor accounted for 16 months of work during the year. This results in a total of 32 months of labor expended in the operation of the average dairy farm in 1946, or the equivalent of 2.7 men working for the entire year.

Counting the amount of work done by one man in a 10-hour day as a productive man work unit, there was an average of 180 productive man work units expended on crop production, 430 on livestock, and 27 for other activities. Sixty per cent of the man labor was used for livestock, and practically all of this labor was devoted to the dairy enterprise.

Since the average man accomplished 236 10-hour days of work on the farm during the year, it may be concluded that dairy farms as a whole made efficient or at least full use of their labor during the year.

Farm Receipts

Total farm receipts averaged $13,473 per farm in 1946. Sixty-eight per cent of the receipts resulted from the sale of milk (Table 5).

TABLE 5. Farm Receipts, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Source of receipts	Farm receipts: Dollars	Farm receipts: Per cent of total
Average per farm:		
Dairy products	9,239	68
Dairy cattle sold	703	5
Other livestock receipts	209	2
Total, livestock and livestock products	10,151	75
Crops	623	5
Government subsidy[1]	586	4
Machinery and equipment sold	6	—
Other receipts	515	4
Increase in farm capital	1,592	12
Total farm receipts	13,473	100
Per cent of farm receipts from the dairy enterprise	86	

[1] Wartime milk subsidy payments were in effect until June, 1946, at which time they were discontinued.

Of all farm receipts, 86 per cent came from the dairy enterprise, including dairy product sales, sales of dairy animals, government milk subsidy, and increase in inventory value of dairy stock.[5] Receipts from crops were of minor importance and accounted for only 5 per cent of total receipts. The source of farm receipts indicates the specialized nature of dairy farms in the North Louisiana Upland Cotton Area.

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[5] Dairy enterprise receipts were $11,604 (Table 12).

Farm Expenses

Average farm expenses amounted to $10,819 (Table 6). Purchased feed was the largest individual item of expense, averaging $5,834 per farm, or 54 per cent of all expenses. Livestock purchases were second in importance, being $1,336 per farm, or 12 per cent of all expenses. Man labor was next in importance, amounting to $1,248 per farm, or 12 per cent of all expenses.

TABLE 6. Farm Expenses, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

	Farm expenses	
Item	Dollars	Per cent of total
Average wage per farm:		
Hired labor	1,014	10
Cropper labor	234	2
Total labor	1,248	12
Custom work	21	—
Board	26	—
Repairs to machinery	115	1
Repairs to bldgs. and fences	119	1
Truck costs	259	2
Tractor costs	69	1
Auto costs	63	1
Hauling milk and feed	359	3
Feed	5,834	54
Salt	27	—
Fertilizer	193	2
Seed	63	1
Ginning	13	—
Sprays and disinfectants	45	—
Ice	25	—
Electricity	135	1
Other utilities	17	—
Taxes	34	—
Insurance	21	—
Miscellaneous livestock expenses	58	1
Miscellaneous	67	1
Total current expenses	8,816	81
Livestock purchased	1,336	12
Machinery and equipment purchased	168	2
Dairy equipment purchased	72	1
Real estate improvements	138	1
Land rent	91	1
Decrease in farm capital	198	2
Total other expenses	2,003	19
Total farm expenses	10,819	100
Per cent of farm expenses for the dairy enterprise		86

Eighty-six per cent of all farm expenses were assessed to the dairy enterprise. Thus it is apparent that the dairy enterprise accounted for 86 per cent of the farm receipts and was responsible for 86 per cent of the farm expenses.

Farm Returns

The average family income on these farms (gross receipts less gross expenses) was $2,655 (Table 7). This represents the amount received by the farm operator and his family for their year's work and management and for the use of all farm capital. When the value of unpaid family labor is subtracted from the family income, a farm income of $2,170 is obtained. This is the amount the operator received for his year's labor and management and for the use of all farm capital. If an interest charge on farm capital of 5 per cent is deducted from farm income, the operator's labor income is obtained. The average labor income was $1,175. This represents what the farmer received for his year's work in addition to the use of a house and products furnished by the farm. If the value of farm privileges, which averaged $873 per farm, is added to labor income, the farmers had labor earnings of $2,048 per farm. The operator's labor earnings represent the return to the farmer for his labor and management for the year plus the value of a house to live in and other perquisites.

TABLE 7. Business Summary, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Per farm
	Dollars
Average per farm:	
1. Total capital	19,894
2. Farm receipts	13,474
3. Farm expenses	10,819
4. Family income (2 minus 3)	2,655
5. Unpaid family labor	485
6. Farm income (4 minus 5)	2,170
7. Interest on capital (at 5%)	995
8. Labor income (6 minus 7)	1,175
9. Farm privileges	873
10. Labor earnings (8 plus 9)	2,048
11. Estimated value of operator's labor	1,538
12. Return on capital (6 minus 11)	632
13. Per cent return on farm capital	3.2%

The value placed by farm operators on their labor and management for the year amounted to $1,538. Subtraction of this amount from the farm income of $2,170 leaves a return to farm capital of $632. This represents a return to farm capital of 3.2 per cent.

Variation in Returns—The 54 dairy farms varied widely in their income-producing ability. This is evident from the variations in labor income on individual farms, as shown in Figure 2. The highest labor income was $5,411 and the lowest labor income was a minus $2,723. Twenty-eight per cent of the farms in this study had a negative labor income, 46 per cent had a labor income less than $1,000, and 33 per cent had a labor income of $2,000 or more.

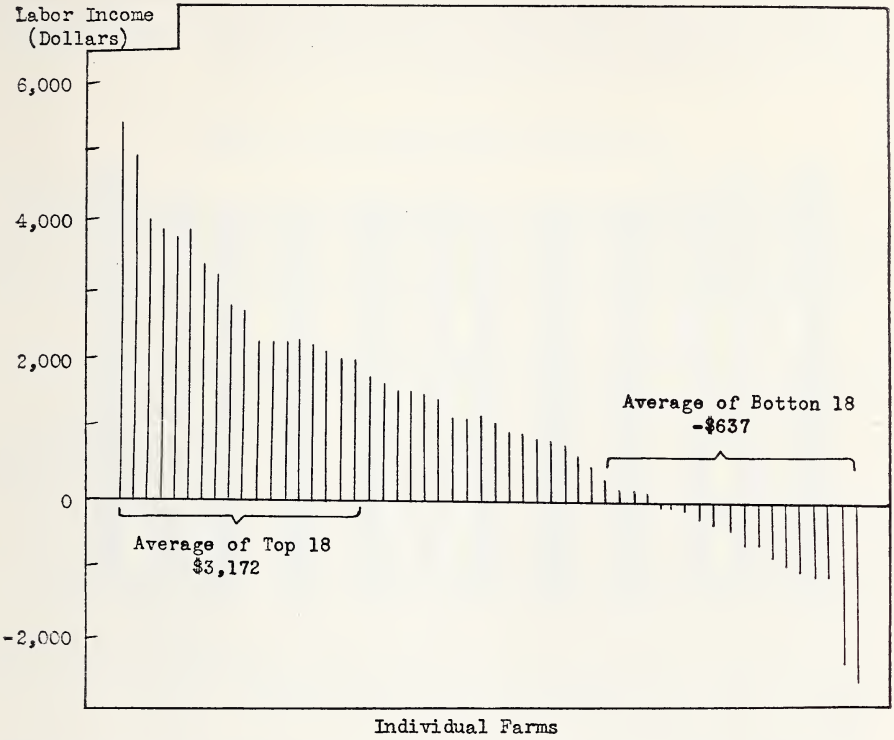

FIG. 2.—Variation in Labor Income on 54 Dairy Farms, North Louisiana Upland Cotton Area.

These results reaffirm the seriousness of the problem with which the dairy industry of this section is confronted, and show conclusively that better management and significant reorganization of farms are necessary if farmers expect to operate their dairy farms on a profitable basis.

The following sections dealing with the dairy enterprise and the farm business attempt to point out some of the causes for the wide variations in income among farms.

THE DAIRY ENTERPRISE

The discussion on the various aspects of the dairy enterprise is presented as follows: (1) production and disposition of milk, (2) cost of producing milk, (3) enterprise returns, and (4) feeding practices.

Wide variations were found in the enterprise on the 54 farms included in this study. This size of dairy herds varied considerably and ranged from 11 to 163 cows per farm. The average for all farms was 53 cows. Of this number, 64 per cent, or 34.1 cows, were being milked throughout the year. Or stating this another way, the average cow was milked about 8 months out of the year.

Production and Disposition of Milk

The study embraced a total of 2,863 cows that produced 10,908,050 pounds of milk on the 54 farms in 1946. The average production of milk for the year was 202,001 pounds per farm, 74,815 pounds per man equivalent, and 3,811 pounds per cow in the herd (Table 8). Of the milk produced, 93 per cent was sold, 5 per cent was fed to calves, and 2 per cent was consumed by farm families.

TABLE 8. Production and Disposition of Milk, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Production	
	Pounds	Per cent of total
Average per farm:		
Wholesale milk	178,137	88
Retail milk	2,642	1
Surplus milk	6,880	4
Farm use	3,973	2
Calves	10,369	5
Total milk	202,001	100
Pounds of milk per man	74,815	
Pounds of milk per cow in herd	3,811	
Pounds of butterfat per farm	9,218	
Pounds of butterfat per man	3,414	
Pounds of butterfat per cow in herd	174	

The average butterfat production was 9,218 pounds per farm, 3,414 pounds per man, and 174 pounds per cow. The average annual butterfat content ranged from a low of 3.8 per cent per herd to a high of 5.2 per cent per herd. The average monthly butterfat content for all herds ranged from 4.5 per cent in March, April, and July to 5.2 per cent in December (Figure 3).

Cows on farms in the area were primarily of Jersey strain. Twenty-five herds were composed entirely or to a large extent of purebred cows, while 25 others were composed of grade cows, and 4 herds were about evenly divided between purebreds and grades.

The Cost of Producing Milk

The cost of producing milk was calculated according to the direct allocation method. The direct items of expense, such as feed, labor, milk hauling, etc., that were incurred entirely for the dairy were charged directly to the enterprise. Joint costs were allocated on the basis of the use that was attributable to the dairy enterprise.

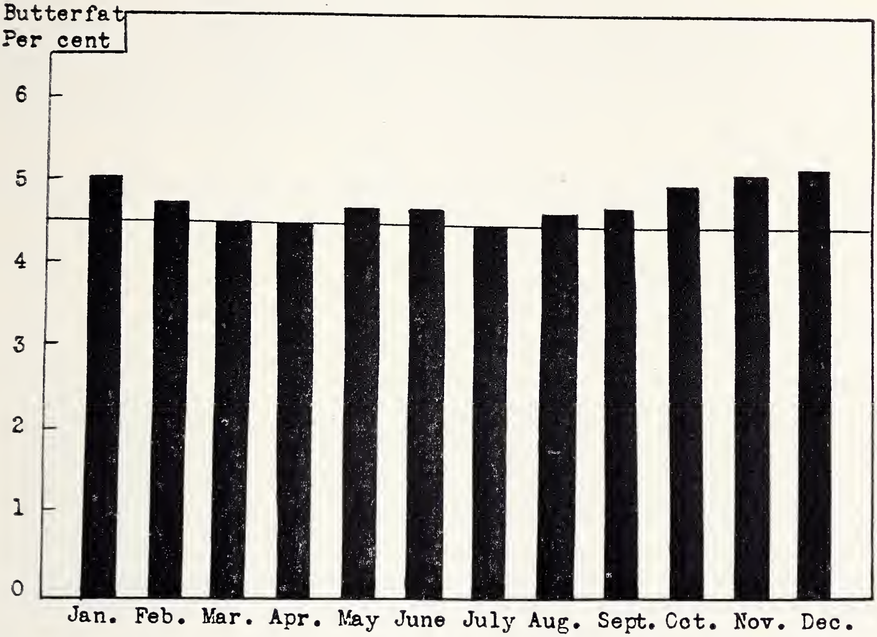

FIG. 3.—Average Monthly Butterfat Content of Milk Sold Wholesale, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946.

Purchased feeds were charged at the price the farmer paid for them. Home-grown feeds were charged to the dairy enterprise at the prevailing farm price in 1946.[6] A flat charge of 30 cents an hour for all labor expended directly on the dairy enterprise was charged to the dairy enterprise on all farms.

Feed Costs—Feed was by far the largest item of cost in the operation of the dairy enterprise, accounting for 62 per cent of the total cost of producing milk. The cost of feed was $113.45 per cow, or $2.98 per 100 pounds of milk produced (Table 9).

Of the feed cost, the greater portion was for purchased feeds, which represented 90 per cent of the total feed cost of the dairy enterprise. The average cost of purchased feed was $102.62 per cow, or $2.69 per 100 pounds of milk produced.

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[6] The cost of producing home-grown feeds was not considered in the valuation of these feeds.

TABLE 9. Average Cost of Feed, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Kind of feed	Feed costs per cow in herd	Feed costs per cwt. of milk	Feed costs per farm	
	Dollars	*Dollars*	*Dollars*	*Per cent of Total*
Feed, purchased:				
Concentrates	92.40	2.42	4,897	81
Roughages	10.22	.27	542	9
Total feed purchased	102.62	2.69	5,439	90
Feed, home-grown:				
Concentrates:				
Corn	1.47	.04	78	2
Oats	.21	.01	11	—
Sweet potatoes	.09	—	5	—
Other	.15	—	8	—
Total	1.92	.05	102	2
Roughages:				
Hay	6.81	.18	361	6
Soybeans	1.42	.04	75	1
Sorgos	.68	.02	36	1
Total	8.91	.24	472	8
Total feed home-grown	10.83	.29	574	10
Total concentrates	94.32	2.47	4,999	83
Total roughages	19.13	.51	1,014	17
Total all feed	113.45	2.98	6,013	100

Purchased concentrates, at $92.40 per cow, or $2.42 per 100 pounds of milk, accounted for 81 per cent of the total feed cost, and purchased roughages, at $10.22 per cow, or $0.27 per 100 pounds of milk, accounted for 9 per cent of the total feed cost.[7]

Home-grown feeds, at $10.82 per cow, or $0.29 per 100 pounds of milk produced, accounted for 10 per cent of the feed cost of the dairy enterprise.

Concentrates accounted for 83 per cent of the total feed cost as compared to 17 per cent for roughages. Purchased concentrates, consisting principally of 16 per cent and 18 per cent protein commercial mixed dairy feeds, accounted for 98 per cent of the total cost of concentrates, while home-grown concentrates accounted for the remaining 2 per cent. Purchased roughages accounted for 53 per cent of the total cost of roughages, while home-grown roughages made up the remaining 47 per cent.

Labor, Power and Equipment Costs—The charge for labor, power, and equipment for the production and hauling of milk is presented in Table 10. This amounted to 20 per cent of the total costs of conducting the dairy enterprise. This charge may be broken down into production costs of $29.22 per cow, or $0.77 per 100 pounds of milk, and milk hauling costs of $6.94 per cow, or $0.18 per 100 pounds of milk.

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[7] All references in this study to roughages mean dry roughages.

An average of 77 hours of man labor was spent on each cow in the herd, at a cost of $23.05 per cow, or $0.61 per 100 pounds of milk. This accounted for 64 per cent of the total labor, power, and equipment cost of conducting the dairy enterprise.

TABLE 10. Average Labor, Power and Equipment Costs, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Costs per cow in herd	Costs per cwt. of milk	Cost per farm	
	Dollars	*Dollars*	*Dollars*	*Per cent of Total*
Production:				
Labor	23.05	.61	1,122	64
Truck use	2.26	.06	120	6
Dairy equipment use	1.64	.04	87	5
Auto use	1.02	.03	54	3
Feed hauling	1.25	.03	66	3
Total	29.22	.77	1,549	81
Milk hauling:				
Truck use	1.45	.04	77	4
Hired milk hauling	5.49	.14	291	15
Total	6.94	.18	368	19
	Summary			
Production and hauling:				
Labor	23.05	.61	1,222	64
Truck use	3.72	.10	197	10
Dairy equipment use	1.64	.04	87	5
Auto use	1.02	.03	54	3
Feed hauling	1.25	.03	66	3
Hired milk hauling	5.49	.14	291	15
Total	36.17	.95	1,917	100
Hours of man labor	77	2.0	4,074	
Returns per hour of labor			78 cents	

The average cost of getting the milk from the farm to the milk plant was $0.18 per 100 pounds. A few farmers hauled their own milk to market in their own trucks but most farmers hired their milk hauled to market by local routemen.

Pasture Costs—The cost of pasture for the dairy herd on the 54 farms was $13.45 per cow, or $0.35 per 100 pounds of milk produced, representing 7 per cent of the total enterprise expenses.

Other Costs—Costs other than for feed, labor, power, and equipment, and pasture amounted to $19.02 per cow, or $0.50 per 100 pounds of milk produced. These costs included the cost of crops pastured, farm building use, depreciation of dairy cattle, interest on dairy cattle, and other miscellaneous costs.

Summary of Costs of Producing Milk—The average cost of producing milk was $4.78 per 100 pounds of milk produced (Table 11). However, due primarily to differences in feed and labor expenses among farms, there were great variations in cost on individual farms. Cost per 100 pounds of milk produced on individual farms ranged from $3.35 to $8.37.

TABLE 11. Average Cost of Producing Milk, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Cost items	Costs per cow in herd	Costs per cwt. of milk	Cost per farm	
	Dollars	*Dollars*	*Dollars*	*Per cent of Total*
Feed	113.45	2.98	6,013	62
Labor, power and equipment—Prod.	29.23	.77	1,549	16
Labor, power and equipment—Mkt.	6.94	.18	368	4
Crops pastured	1.64	.04	87	1
Pasture land usage	13.45	.35	713	7
Farm building use	3.89	.10	206	2
Depreciation of dairy cattle	1.64	.04	87	1
Interest on dairy cattle	6.34	.17	336	4
Miscellaneous	5.51	.15	292	3
Total	182.09	4.78	9,651	100

Variation in production costs were so great that it is reasonably obvious that there is urgent need for improving management practices on many individual farms. It is realized that all farms will not be able to produce milk at the lowest cost or at the same cost because of variations in the size of business and other related factors, but it is vital to the industry that farmers with excessive production costs examine their operations with the view of increasing efficiency and reducing unnecessary costs.

Enterprise Returns

Receipts from the Dairy Enterprise—Dairy receipts include the following:

(1) The cash value of all milk sold, which includes milk sold at wholesale and retail and surplus milk that is sold at wholesale for manufacturing purposes.

(2) The estimated value of milk used for human consumption on the farm.

(3) The estimated value of milk fed to calves on the farm.

(4) The estimated value of all manure produced.

(5) The estimated value of all beef contributed by the dairy enterprise for home consumption.

(6) The government milk subsidy received during the first 6 months of 1946.

(7) The appreciation of the dairy herd.

Total dairy receipts averaged $11,604 per farm, $218.94 per cow in the herd, or $5.74 per 100 pounds of milk produced (Table 12).

Milk Receipts—Milk receipts averaged $10,503 per farm, $198.16 per cow in the herd, and $5.20 per 100 pounds of milk produced. Receipts from milk, both cash and non-cash, accounted for 91 per cent of the dairy enterprise returns. Sales of wholesale milk averaged $8,702 per farm, or $164.19 per cow in the herd, and represented 75 per cent of the total receipts from the dairy enterprise. Retail sales were $230 per farm, or $4.34 per cow in the herd. Sales of surplus milk accounted for $376 per farm, or $7.09 per cow in the herd. The value of milk consumed on the farm was $200 per farm, or $3.77 per cow, and the value of milk fed to calves was $415 per farm, or $7.83 per cow. The government subsidy received during the first 6 months of 1946 accounted for 5 per cent of all dairy receipts and averaged $580 per farm, or $10.94 for each cow in the herd.

TABLE 12. Receipts from the Dairy Enterprise, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Source of receipts	Receipts per cow in herd	Receipts per cwt. of milk	Receipts per farm	
	Dollars	*Dollars*	*Dollars*	*Per cent of Total*
Milk:				
Wholesale	164.19	4.31	8,702	75
Retail	4.34	.11	230	2
Surplus	7.09	.19	376	3
Farm use	3.77	.10	200	2
Calves	7.83	.20	415	4
Subsidy payments	10.94	.29	580	5
Total milk	198.16	5.20	10,503	91
Dairy cattle appreciation	13.96	.37	740	6
Manure used	6.51	.17	345	3
Beef	.30	—	16	—
Total receipts	218.94	5.74	11,604	100
Net enterprise returns over expenses	36.85	.96	1,953	

Other Receipts—Appreciation of the dairy herd accounted for

6 per cent of the dairy receipts. The estimated value of manure produced amounted to 3 per cent of the total receipts.

Summary of Returns—Total receipts from the dairy enterprise were $11,604 per farm, $218.94 per cow in the herd, or $5.74 per 100 pounds of milk produced. The total expenses of the enterprise were $9,651 per farm, $182.09 per cow, and $4.78 per 100 pounds of milk produced.[8] The average net return over expenses for the dairy enterprise was $1,953 per farm, $36.85 per cow, or $0.96 per 100 pounds of milk produced.

Feeding Practices

Feed was the most important single item of cost in producing milk in the North Louisiana Upland Cotton Area, accounting for over 60 per cent of the total cost. The importance of feed in milk production suggests the desirability of following the best feeding practices that are recommended to dairy farmers in the area.

The feeding practices followed by most farmers participating in this study varied widely from farm to farm and in the main fell far short of recommended feeding standards. It is probable that the adoption of better feeding practices would do more to increase net returns to the dairy enterprise than any other single factor.

In evaluating the adequacy of the feeding practices employed in the area, it should be recognized that the farmers interviewed were in many cases uniformed as to recommended feeding standards and also that feed was extremely scarce and difficult to obtain during the period covered in this survey. Many dairy farmers would have done a better job of feeding if feed supplies had been adequate. In the appraisal of feeding practices the following points were considered to be of significant importance:

(1) Kind and amount of feed used.

(2) Feeding according to individual production.

(3) Concentrate—roughage ratio.

(4) Milk—concentrate ratio.

Kind and Amount of Feed Used—The kind and amounts of feed used are presented in Table 13. Kinds of feed are summarized as to purchased or home-grown concentrates and purchased or home-grown roughages.

The average quantity of concentrates fed per farm amounted to 140,063 pounds of which 98 per cent was purchased and 2 per cent

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[8] See Table 11.

TABLE 13. Kind and Amounts of Feed Used, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Kind of feed	Pounds of feed per cow in herd	Pounds of feed per cwt. of milk	Feed per farm	
			Pounds	Per cent of total
Concentrates, purchased	2,583	67.8	136,913	98
Concentrates, home-grown:				
Corn	46	1.2	2,438	—
Oats	6	.1	293	—
Sweet potatoes	3	.1	148	—
Other	5	.1	271	—
Total	60	1.5	3,150	2
Total concentrates	2,643	69.3	140,063	100
Roughages, purchased	754	19.8	40,000	50
Roughages, home-grown:				
Hay	611	16.0	32,400	40
Soybeans	87	2.3	4,600	6
Sorgos	56	1.5	3,000	4
Total	754	19.8	40,000	50
Total roughages	1,509	39.6	80,000	100
Ratio—Concentrates to roughages				1:0.6
Pounds of milk per pound of concentrates				1.4

was home-grown. The average quantity of roughages fed per farm amounted to 80,000 pounds of which 50 per cent was purchased.

It should be observed that dairymen in the North Louisiana Upland Cotton Area depend almost completely upon purchased concentrates, and only half of all roughages are produced on the farm. This dependence of dairy farmers on purchased feeds has considerable influence upon their feeding practices and is largely responsible for the poor feed balance that exists on most farms.

Feeding According to Individual Production—It is vital that individual cows be fed sufficient feed to provide the necessary nutrients for milk production. If cows of high production capacity are not fed adequately, milk production declines to the level afforded by the nutrients they receive. Many individual cows are potentially high producers but are forced to be lower producers because they are not given the proper kinds and amounts of feed. It is just as unwise to overfeed a poor milk producer as it is to underfeed a good milk producer. Cows with low milk production capacity do not make full use of liberal feeding and only store up excess food nutrients in the form of body fat. Feeding individual dairy cows according to production enables farmers to eliminate the "boarders."

As to the feeding of concentrates, C. H. Staples, an outstanding dairy authority of the South, has stated: "The best plan for grain feeding is to make up a grain mixture for the average of the herd and then feed each cow in proportion to production. Best results can be obtained only by carefully observing each cow and feeding her according to her requirements. The keeping of an accurate production record by weighing and testing milk is fundamental in securing the maximum production from a dairy cow."[9]

This practice of mixing a grain ration and feeding according to individual production has been a major principle for dairy farmers in the important dairy areas for a long time. Despite this tested principle, only 4 of the 54 farmers interviewed were making an attempt to follow this practice. Most of the farmers were feeding their cows the same amount of feed regardless of production.

Concentrate—Roughage Ratio—In order to secure the greatest net returns from dairying, one of the first essentials is to provide the cows with an abundance of good quality roughage. In the more successful dairy areas cows are usually fed about 3 to 3.5 pounds of roughage for each pound of concentrates. Likewise, in this area the ratio of concentrates to roughages should be about 1 to 3 or 3.5, yet the ratio prevailing on the 54 farms included in this study was 1 pound of concentrates to 0.6 pound of roughage in 1946.

Without question, larger quantities of roughages should be fed to dairy animals in this area; however, it is questionable if the increased feeding of roughages should be brought about through larger purchases. Additional roughage should be produced on the farm. On the basis of enterprise information available on roughage crops in the North Louisiana Upland Cotton Area, it appears desirable, feasible, and profitable for farmers to follow recommended cultural and fertilization practices in the production of forage crops and to produce sufficient forage to meet the minimum requirements of the dairy herd.

Roughage requirements of the dairy herd in this area could be met in part for a large part of the year by the improvement of farm pastures.

Milk—Concentrate Ratio—The milk-concentrate ratio refers to the number of pounds of milk that are obtained from one pound of concentrates. This ratio, or the production of milk per pound of feed, is very low in the North Louisiana Upland Cotton Area. In most successful dairy areas, a production of 2.5 to 3 pounds of milk per pound of concentrates would be considered standard, but only 1.4 pounds of milk were obtained per pound of concentrates fed on the dairy farms included in this survey (Table 13).

An average of 2.643 pounds of concentrates per cow was fed in

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[9] Staples, C. H., *How to Select Dairy Cattle and Develop the Dairy Herd,* Extension Circular No. 121, May 1929, Louisiana State University, p. 17.

1946 (Table 13.)[10] The amount of concentrates fed ranged from a herd average of 1,152 pounds per cow annually to a herd average of 5,784 per cow. An average of 10 pounds of concentrates was fed daily to each cow that was being milked. The daily amount fed varied seasonally, ranging from 12 pounds per cow in the winter to 9.5 pounds in the spring, 8.5 pounds in the summer and 10.5 pounds in the fall.

The low milk-to-grain ratio was largely caused by the following: (1) the failure of dairymen to feed according to individual production, (2) the low ratio of roughages to concentrates, (3) the practice of wintering dry cows on high priced concentrates rather than on roughages, (4) feeding young stock and bulls a high proportion of concentrates to roughages, and (5) the inadequacy of pastures for providing a sufficient supply of succulent feed.

Summary on Feeding Practices—In evaluating the adequacy of the feeding practices employed, as well as in appraising those practices that are recommended, it is essential that the following things be considered:

(1) The type and amount of feed that is produced locally in the area.

(2) The degree that dairy farmers depend upon the purchase of commercial feed.

(3) The concentrate—roughage ratio and the relative prices of concentrates and roughages.

(4) The milk-feed ratio and the relative prices of milk and feed.

(5) The opportunity of producing more feed on the farm.

Probably the best way to increase profits from the dairy business in the area is for farmers to adopt approved practices insofar as feasible in order to make more efficient use of their feed and consequently their dairy cows. Ways in which the farmers can cut their production costs are: (1) feed cows according to production, (2) feed dry cows, young stock, and bulls less concentrates and more roughages, (3) fertilize and improve pastures in order to provide grazing for the dairy herd most of the year, (4) fertilize and adopt other recommended practices in the production of forage crops, and (5) grow enough roughages on the farm to provide the proper balance between concentrates and roughages.

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[10] Feed calculations were made on the basis of the whole herd including cows, bulls, and young stock. For this reason the amount fed per 100 pounds of milk and the feeding rates were higher than would be the case were they expressed in terms of producing cows only. The herd bulls and young cows are very closely associated with the maintenance of the normal milking herd. Therefore, losses or gains which accrue in this part of the dairy enterprise are reflected in the cost of producing milk.

ANALYSIS OF THE DAIRY FARM BUSINESS

In order to analyze the dairy farm business and find out why some farms met with greater financial success than did others, various factors which bear a relationship or association to the success of the farm business have been studied. It is necessary to know the significance and relative importance of each of these factors to the financial success of dairy farms before a clear and accurate appraisal can be made of needed adjustments and farm re-organization.

Numerous farm management studies over past years have demonstrated the major importance of the following factors on the financial success of farming: (1) size of farm, (2) feeding efficiency, (3) labor efficiency, and (4) rates of production. The data for these farms have been subjected to detailed study and analysis to determine the relationship of these major factors to the farm business and the dairy enterprise.

The number of cows in the herd and the number of cows milked were used as the measure of size of farm. The cost of feed per 100 pounds of milk produced was used as a measure of feed efficiency. Hours of man labor per cow in the herd was the basis of determining the labor efficiency, and production of milk per cow was the basis for evaluating the importance of production rates.

Size of Farm and Its Relationship to Costs and Returns

Relation of the Number of Cows in the Herd to Costs and Returns—The 54 farms were divided into three groups of approximately equal size on the basis of the number of cows in the herd. Farms with less than 31 cows in the herd were considered small farms, 31-73 cows were considered medium, and those with more than 73 cows in the herd were considered large farms. The average number of cows in the herd for all farms was 53.

Returns from the dairy enterprise were greater on the farms with large herds (Table 14). The financial advantage of size is reflected in the dairy enterprise returns per farm, as the large farms had returns of $3,508 as compared with $2,188 on medium-sized farms and $410 on small farms. Labor income and farm income for the farm as a whole were also greater on farms having more than 73 cows in the herd. Returns per hour of man labor were greater on the large farms—91 cents an hour as compared with 85 cents on medium-sized farms and 45 cents on small farms.

There are several other important observations that should be pointed out in evaluating the relationship between the number of cows in the herd and costs and returns:

TABLE 14. Relation of Number of Cows in the Herd to Costs and Returns, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Unit	Number of cows in herd			
		Less than 31	31-73	More than 73	All farms
Number of farms	Number	19	19	16	54
Average number of cows	Number	22	47	97	53
Milk produced per cow	Pounds	4,125	4,277	3,460	3,811
Cost of producing milk per cwt.	Dollars	5.59	4.83	4.48	4.78
Feed cost:					
Per cow	Dollars	132	129	100	113
Per cwt. of milk	Dollars	3.20	3.01	2.89	2.98
Hours of labor:					
Per farm	Hours	2,776	3,972	5,736	4,074
Per cow	Hours	126	85	59	77
Returns per hour of labor	Cents	45	85	91	78
Dairy returns:					
Per farm	Dollars	410	2,188	3,508	1,953
Per cwt. of milk	Dollars	.45	1.09	1.05	.96
Farm income	Dollars	1,183	2,284	3,206	2,170
Labor income	Dollars	483	1,289	1,862	1,175
Per cent return on capital	Per cent	-2.8	3.8	6.3	3.2

(1) The per cent return on capital was larger on the larger farms.

(2) Labor requirements per cow tended to decline sharply as the number of cows in the herd increased.

(3) Feed costs per cow and per 100 pounds of milk produced were lower on the larger farms.

(4) Production rates were lowest on extremely large farms, and highest on the medium-sized farms.

In summary it may be concluded that the larger farms were able to achieve greater efficiency in the use of labor and feed. This resulted in lower production costs per 100 pounds of milk and offset lower production rates and slightly lower returns per 100 pounds of milk produced.[11] As a result, dairy enterprise returns per farm, labor income, and return to capital were all greater on the larger farms.

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[11] Farms with the greatest total returns from the dairy enterprise and the lowest per unit cost of production did not have the highest returns per 100 pounds of milk produced. This was due in part to the low production rates per cow on large farms and to the fact that the average price received for wholesale milk on large farms was 20 cents a 100 pounds less than the price received by medium-sized farms and 18 cents per 100 pounds less than the price received by small farms (due primarily to lower butterfat content). It should be emphasized, however, that total returns and not per unit returns are the important aspects in appraising the general success of the farm business. The farms with large herds were the most profitable, and size served as a multiplier of profits on these farms in 1946.

Relation of the Number of Cows Milked to Costs and Returns—The average number of cows milked throughout the year is also a measure of size and is frequently a more precise measure than the number of cows in the herd because it reflects the intensity in the use of the dairy herd. Again the 54 farms were divided into 3 groups as follows:

(a) Small farms—less than 20 cows milked.

(b) Medium-sized farms—20-45 cows milked.

(c) Large farms—more than 45 cows milked.

Farms milking more than 45 cows had higher returns to the farm business as well as to the dairy enterprise. Farm income on the large farms amounted to $3,187 as compared to $2,266 on medium-sized farms and $1,006 on small farms. Labor income was also greater on the large farms, amounting to $1,720 as compared to $1,401 on the medium-sized farms and $346 on small farms. Per cent return on capital ranged from a negative 4 per cent on the small farms to 5.6 per cent on large farms (Table 15).

Dairy enterprise returns declined from an average of $3,603 on large farms to $334 on small farms. Enterprise returns per 100 pounds of milk were highest on medium-sized farms, $1.10 as compared to $1.04 on large farms and $0.39 on small farms. The large farms were producing more than 2 times as much milk as the medium-sized farms, however, and as a result total returns to the enterprise and the farm business were considerably greater. Returns per hour of labor were more than 2 times as great on large farms as on small farms—93 cents an hour as compared to 42 cents.

Greater efficiency in the use of labor and lower feed costs per cow on the large farms resulted in lower production costs per 100 pounds of milk. Lower production costs were achieved on the large farms despite the slightly lower production rates per cow.

The conclusions on the general relationship of the average number of cows milked to costs and returns are similar to those found when the number of cows in the herd was used as the measure of size. Farmers milking the largest number of cows had (1) the highest returns to the farm business, (2) the greatest total returns to the dairy enterprise, (3) the highest returns per hour of man labor, (4) the lowest production costs per 100 pounds of milk produced, (5) the lowest labor requirements per cow, and (6) the lowest feed costs per cow and per 100 pounds of milk produced.

TABLE 15. Relation of Number of Cows Milked to Costs and Returns, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Unit	Number of cows milked			
		Less than 20	20-45	More than 45	All farms
Number of farms	Number	17	19	18	54
Average number of cows	Number	22	43	93	53
Milk produced per cow	Pounds	3,922	3,874	3,756	3,811
Cost of producing milk per cwt.	Dollars	5.63	5.05	4.44	4.78
Feed cost:					
Per cow	Dollars	123	120	108	113
Per cwt. of milk	Dollars	3.14	3.09	2.88	2.98
Hours of labor:					
Per cow	Hours	2,721	3,746	5,697	4,074
Per farm	Hours	126	86	61	77
Returns per hour of labor	Cents	42	79	93	78
Dairy returns:					
Per farm	Dollars	334	1,840	3,603	1,953
Per cwt. of milk	Dollars	.39	1.10	1.04	.96
Farm income	Dollars	1,006	2,266	3,187	2,170
Labor income	Dollars	346	1,401	1,720	1,175
Per cent return on capital	Per cent	-4.0	4.1	5.6	3.2

Feeding Efficiency and Its Relationship to Costs and Returns

The cost of feed was by far the largest item of expense in producing milk in the North Louisiana Upland Cotton Area, accounting for over one-half of the total enterprise expenses. The average cost of feed was $113 per cow, or $2.98 per 100 pounds of milk produced. Efficiency in the use of feed is probably one of the most important factors affecting the success of dairying and profits on dairy farms. The 54 farms were divided into 3 groups of approximately equal size in order to evaluate the importance of feed costs per unit of milk produced. The three groups were as follows:

(a) Farms having a feed cost of less than $2.60 per 100 pounds of milk produced.

(b) Farms having a feed cost of $2.60 to $3.30 per 100 pounds of milk produced.

(c) Farms having a feed cost of more than $3.30 per 100 pounds of milk produced.

Farmers having lower than average feed cost per 100 pounds of milk produced had higher returns to the farm business and to the dairy enterprise. The farm income on farms where feed costs were less than $2.60 per 100 pounds of milk produced averaged $2,677 as compared with $1,645 on farms with feed costs of $2.60 to $3.30 and $2,156 on farms having feed costs in excess of $3.30 per 100 pounds of milk (Table 16). Labor income followed a similar pattern. Returns per hour of man labor on farms with lower than average feed costs were double those on farms having feed costs in excess of $3.30 per 100 pounds of milk produced—$1.02 as compared to 51 cents. Per cent return on capital ranged from 6.5 per cent where feed costs were less than average to 1 per cent on farms having medium feed costs and 1.9 per cent on farms having above average feed costs.

Several things should be pointed out that resulted in relatively low returns on farms having higher than average feed costs. It should be observed that those farms had lower than average production rates per cow, and this was a major reason why unit feed costs were higher. Milk production costs were extremely high—$5.97 per 100 pounds as compared to $4.68 on farms with medium feed costs and $4.08 on farms with the lowest feed costs. As a consequence the dairy enterprise returns per farm were very low, and returns per 100 pounds of milk were only 49 cents as compared to 91 cents on farms

TABLE 16. Relation of Cost of Feed per 100 Pounds of Milk Produced to Costs and Returns, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Unit	Cost of feed per 100 pounds of milk			
		Less than $2.60	$2.60-3.30	More than $3.30	All farms
Number of farms	Number	19	18	17	54
Average number of cows	Number	55	55	49	53
Milk produced per cow	Pounds	4,010	4,040	3,285	3,811
Cost of producing milk per cwt.	Dollars	4.08	4.68	5.97	4.78
Feed cost:					
Per cow	Dollars	96	120	127	113
Per cwt. of milk	Dollars	2.40	2.98	3.86	2.98
Hours of labor:					
Per farm	Hours	4,082	4,392	3,728	4,074
Per cow	Hours	75	80	76	77
Returns per hour of labor	Cents	102	76	51	78
Dairy returns:					
Per farm	Dollars	2,924	2,024	794	1,953
Per cwt. of milk	Dollars	1.34	.91	.49	.96
Farm income	Dollars	2,677	1,645	2,157	2,170
Labor income	Dollars	1,730	751	1,003	1,175
Per cent return on capital	Per cent	6.5	1.0	1.9	3.2

with average feed costs and $1.34 on farms with lower than average feed costs.

Low dairy enterprise returns on farms with excessive feed costs were offset largely by proportionately higher crop receipts and receipts from other sources. In other words, the dairy enterprise was of relatively less importance to the farm business on these farms than on either of the other groups of farms.

Labor Efficiency and Its Relationship to Costs and Returns

Efficiency in the use of labor is a major factor affecting the financial success of farming. This is especially true for dairy farms, as the dairy enterprise requires a large amount of man labor. It is believed that the hours of man labor per cow in the herd is probably the best measure of labor efficiency on dairy farms, at least where the dairy enterprise is dominant in the farm organization. The average man labor requirement for the 54 farms in this study was 6,370 man hours in 1946, of which 4,074 hours were expended directly on the dairy enterprise.

The 54 farms were divided into 3 groups on the basis of the hours of man labor expended per cow. The 3 groups were as follows:

(a) Farms requiring less than 65 man hours per cow.

(b) Farms requiring 65-100 man hours per cow.

(c) Farms requiring more than 100 man hours per cow.

The average labor required per cow in the herd for all farms was 77 hours. This comprised all labor expended on the dairy enterprise, including the time spent in caring for heifers, calves, and bulls. The average labor cost amounted to $23.05 per cow in the herd, or $0.61 per 100 pounds of milk produced. The labor cost on individual farms was calculated at a flat rate of 30 cents an hour.

The average cost of labor per cow was $15.76 on farms with the lowest labor requirements, $24.79 on farms with medium labor requirements, and $40.54 on farms with the highest labor requirements per cow in the herd.

Farmers that achieved the most efficient use of labor had the highest returns to the dairy enterprise as well as to the farm business (Table 17). Per cent return on capital declined from 6 per cent on farms where less than 65 man hours were required per cow to 2.9 per cent where 65-100 hours were required and to a negative 0.4 per cent where more than 100 man hours were required per cow in the herd.

The cost of producing milk was closely associated with efficiency

TABLE 17. Relation of Hours of Man Labor per Cow to Costs and Returns, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Unit	Hours of man labor per cow: Less than 65	65-100	More than 100	All farms
Number of farms	Number	17	19	18	54
Average number of cows	Number	87	45	30	53
Milk produced per cow	Pounds	3,461	4,177	4,190	3,811
Cost of producing milk per cwt.	Dollars	4.51	4.63	5.61	4.78
Feed cost:					
Per cow	Dollars	101	122	134	113
Per cwt. of milk	Dollars	2.92	2.92	3.19	2.98
Hours of labor:					
Per farm	Hours	4,584	3,676	4,012	4,074
Per cow	Hours	52	83	135	77
Returns per hour of labor	Cents	99	82	51	78
Dairy returns:					
Per farm	Dollars	3,184	1,902	846	1,953
Per cwt. of milk	Dollars	1.06	1.02	.68	.96
Farm income	Dollars	3,050	1,906	1,616	2,170
Labor income	Dollars	1,858	921	797	1,175
Per cent return on capital	Per cent	6.0	2.9	-0.4	3.2

in the use of labor. The cost per 100 pounds of milk produced increased from $4.51 on farms where less than 65 man hours were required per cow to $4.63 on farms with medium labor requirements and to $5.61 on farms where labor requirements exceeded 100 man hours per cow in the herd.

Production rates were lower on the farms with low labor requirements; however, feed costs were also lower. Efficiency in the use of man labor, which was also closely associated with size of the herd and other closely associated factors, largely offset lower production rates. As a result the returns per hour of man labor expended on the dairy enterprise on farms making efficient use of labor were nearly double those obtained on farms where labor requirements exceeded 100 man hours per cow—99 cents as compared to 51 cents an hour.

Production Rates and Their Relationship to Costs and Returns

The pounds of milk produced per cow in the herd is a good measure of production efficiency on dairy farms. It has been established by previous research in other dairy areas that production rates per cow are usually very closely associated with the success of the dairy enterprise and of the whole farm business where dairying is a major enterprise.

The 54 dairy farms were grouped on the basis of milk production per cow as follows:

(1) Low production rates—where less than 3,500 pounds of milk were produced per cow.

(2) Medium production rates—where 3500 to 4500 pounds of milk were produced per cow.

(3) High production rates—where 4500 pounds of milk or more were produced per cow.

Returns to the dairy enterprise and to the farm business were higher when the production rate per cow exceeded 3500 pounds of milk (Table 18). On farms where production rates exceeded 4500 pounds, however, returns to the farm business declined. Returns per 100 pounds of milk produced were also greatest on farms where production rates exceeded 3500 pounds.

The per cent return on farm capital was highest on the group of farms with medium production rates, amounting to 4.5 per cent,

TABLE 18. Relation of Milk Production per Cow to Costs and Returns, 54 Dairy Farms, North Louisiana Upland Cotton Area, 1946

Item	Unit	Pounds of milk per cow			
		Less than 3,500	3,500-4,500	More than 4,500	All farms
Number of farms	Number	18	18	18	54
Average number of cows	Number	62	54	43	53
Milk produced per cow	Pounds	2,850	3,943	5,048	3,811
Cost of producing milk per cwt.	Dollars	5.37	4.51	4.56	4.78
Feed cost:					
Per cow	Dollars	95	107	148	113
Per cwt. of milk	Dollars	3.34	2.72	2.93	2.98
Hours of labor:					
Per farm	Hours	4,012	4,188	4,030	4,074
Per cow	Hours	64	78	94	77
Returns per hour of labor	Cents	58	86	89	78
Dairy returns:					
Per farm	Dollars	1,134	2,340	2,386	1,953
Per cwt. of milk	Dollars	.64	1.10	1.10	.96
Farm income	Dollars	2,102	2,294	2,112	2,170
Labor income	Dollars	1,109	1,376	1,040	1,175
Per cent return on capital	Per cent	3.2	4.5	2.0	3.2

as compared with a return of 3.2 per cent on the farms with low production rates and 2 per cent on the farms with the highest production rates per cow.

The cost of producing milk was lowest where medium production rates were obtained and averaged $4.51 per 100 pounds of milk produced, as compared with $4.56 where high production rates were obtained and $5.37 on farms with low production rates. Feed costs per 100 pounds of milk produced were lowest on farms obtaining medium production rates and highest on farms with low production rates.

Farms having the highest production rates tended to be smaller than average and also had higher than average labor requirements per cow. It has been shown that over-all farm profits are a function of size and are also closely associated with efficiency in the use of labor. Higher than average labor requirements per cow on farms obtaining higher than average production rates coupled with the fact that these farms were smaller than average reduced materially the advantages of obtaining high rates of production. The size of herd and efficiency in the use of man labor were largely responsible for reasonably high returns to the farm business on farms with low production rates. Even though the cost of feed per 100 pounds of milk produced was higher on the farms with low production rates, the cost of feed per cow was less than two-thirds as much as it was on farms with high production rates. This indicates that reasonably efficient use was being made of feed on farms with low production rates. *The unfavorable ratio existing between milk and feed prices tended to reduce materially the advantage of heavy feeding as a means of achieving higher rates of production during the period covered in this study.*

SUMMARY

1. The average investment in the farm business was $19,894, of which $10,404 was in real estate, $7,152 was in livestock, and the remaining $2,338 was in equipment, machinery, feed and supplies.

2. Farm receipts averaged $13,473, of which 86 per cent was derived from the dairy enterprise. Farm expenses averaged $10,819 per farm and 86 per cent was chargeable to the dairy enterprise.

3. Farm income, which represents the return to the operator for his year's work and management and for the use of his farm capital, averaged $2,170 per farm. If the usual interest rate of 5 per cent is deducted from farm income, the average farmer had a labor income of $1,175 for his labor and management during the year. The average return to farm capital amounted to $632 or 3.2 per cent.

The farm business summary indicates that dairy farming in the North Louisiana Upland Cotton Area was not exceedingly profitable in 1946. The only reason that many farmers were able to remain in business was the fact that they were able to obtain much of their necessary living requirements from the farm. Labor earnings, which is obtained by adding the estimated value of farm privileges to labor income, averaged $2,048 per farm.

4. There was an average of 53 dairy cows per farm, of which 34 were milked throughout the year. Each cow was milked for about 8 months out of 12. An average of 32 months of man labor per farm was required during the year, or the equivalent of 2.7 men working for the year.

5. Average milk production per farm amounted to 202,001 pounds of milk, of which 88 per cent was sold at wholesale as Grade A milk. Milk production per cow averaged 3,811 pounds.

6. The average cost of producing 100 pounds of milk was $4.78. Of this amount, 62 per cent was for feed and 20 per cent was for labor, power, and equipment.

7. Man labor requirements averaged 77 hours per cow, and returns per hour of labor averaged 78 cents.

8. Purchased feeds represented 90 per cent of the total feed costs. Home-grown feeds made up the remaining 10 per cent. Purchased concentrates accounted for 98 per cent of the total concentrates fed, while purchased roughages accounted for only 53 per cent of the total value of roughages fed.

9. Dairy enterprise receipts amounted to $5.74 per 100 pounds of milk produced. Sales of wholesale milk accounted for three-fourths of the total dairy receipts.

10. Net returns to the dairy enterprise amounted to $0.96 per 100 pounds of milk produced.

11. Feeding practices varied widely from farm to farm and in the main fell far short of recommended standards. Failure to feed according to individual production and failure to achieve balanced rations resulted in inefficient use of the available feed and low production rates. It is probable that the adoption of better feeding practices would do more to increase net returns to the dairy enterprise than any other single factor.

12. It is important to evaluate the significance of important factors affecting the financial success of dairy farms before a clear and accurate appraisal can be made of needed adjustments.

Labor incomes varied widely from a high of $5,411 to a negative $2,723. Twenty-eight per cent of the farmers in this study had a negative labor income and only 33 per cent had a labor income exceeding $2,000. From this it can be seen that dairy farms varied widely from the standpoint of financial success.

13. The size of farm as measured by the number of cows in the herd was one of the most important factors affecting profits on dairy farms. The larger farms were able to achieve greater efficiency in the use of labor and feed. This resulted in lower production costs per 100 pounds of milk and offset lower production rates and slightly lower returns per 100 pounds of milk produced. As a result, dairy enterprise returns per farm, labor income, and return to farm capital were all greater on the larger farms.

14. The cost of feed was by far the largest item of expense in producing milk. As a rule farmers having lower than average feed costs per 100 pounds of milk produced had higher returns to the farm business and to the dairy enterprise.

15. Efficiency in the use of man labor is a major factor affecting the financial success of farming. Farmers that achieved the most efficient use of labor had the highest returns to the dairy enterprise as well as to the farm business.

16. It has been established by previous research in the important dairy areas that production rates are usually closely associated with the success of dairy farming. Returns to the dairy enterprise and to the farm business in this area were higher when production rates exceeded 3,500 pounds of milk per cow. The cost of producing milk was lowest where medium production rates were obtained. Farms with the highest production rates were smaller than average and farmers failed to use their labor as efficiently as farmers did on those farms obtaining medium and low production rates. Large herds and the corresponding efficiency in the use of man labor were largely responsible for reasonably high returns to the farm business and the dairy enterprise on farms with low production rates. The unfavorable ratio existing between milk and feed prices also tended to reduce materially the advantage of heavy feeding as a means of achieving higher rates of production during the period of this study.

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RICE VARIETIES FOR LOUISIANA

BY

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RICE VARIETY RECOMMENDATIONS

Based on performance in field and nursery tests and availability of seed, the following recommendations for Louisiana can be made:

Early medium-grain	Zenith Magnolia
Early midseason long-grain	Bluebonnet Fortuna Nira
Midseason medium-grain	Blue Rose Blue Rose 41
Late long-grain	Rexoro Texas Patna

CONTENTS

Page

Introduction 4

Classification of varieties 4

Improved characteristics being sought 5

Methods of testing varieties 6

Results of plot experiments 7

Variety recommendations for 1949 7

Illustrations of 12 varieties and leading selections .... 8 and 9

Comparison of varietal characteristics 12

Other varieties 13

Some promising new varieties 14

Rice Varieties for Louisiana[1]

NELSON E. JODON AND D. A. DE LA HOUSSAYE[2]

Introduction

A marked shift to new and improved rice varieties has recently taken place. This was stimulated by established higher prices for certain types and by the adoption of the combine-drier method of harvesting. However, the disease susceptibility and increasingly less satisfactory performance of Early Prolific and Blue Rose also were becoming evident. These were the principal early and late medium-grain varieties grown in the southern rice area for over 25 years. They are being replaced by Zenith and more recently by Magnolia, both productive early varieties better suited for drying and commanding a price comparable to Blue Rose. In the long-grain type there has been a marked increase in the acreage devoted to Rexoro and Fortuna, and the new Bluebonnet variety. These varieties are even better adapted for combining and drying than the medium-grain types and almost always command better prices.

The 1948 crop consisted of too high a proportion of early rice for orderly marketing, and this resulted in many growers returning to the binder-thresher method of harvesting so that they could sack and hold their rice for a more favorable price. The proportion of varieties of the different grain types, and of different maturities will no doubt undergo further adjustment. New varieties being developed at the Rice Experiment Station, Crowley, La., and other rice stations, in cooperation with the U. S. Department of Agriculture, may aid in this adjustment. Rice breeding has progressed so far that adapted improved varieties are becoming available much more rapidly than was possible when introduction from foreign countries and selections from standard varieties were the only sources of new varieties. The grower is always hoping for better and still better varieties, and the breeders are confident that considerable improvement over present varieties is possible.

Classification of Varieties

Varieties may be classified for the practical purposes of the grower and miller on the basis of time of maturity and grain type groups (Table 1).

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[1] Cooperative experiments with the Louisiana Agricultural Experiment Station and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agriculture.

[2] Associate Agronomist and Assistant Agronomist, respectively, Rice Experiment Station, Crowley, La.

Table 1. A Classification of Varieties on the Basis of Time of Maturity and Grain Type.

Grain Type	*Relative Length of Growing Period*			
	Early Maturing	*Medium Early*	*Medium Late*	*Late Maturing*
Approximate days from seeding to maturity	125	140	155	170
Medium	Zenith Magnolia Lacrosse 250		Blue Rose	
Intermediate		Sel. 322A6-23		Sel. 3-72-3
Long		Bluebonnet Fortuna Nira		Texas Patna Rexoro

The earliest varieties now grown commercially mature in about 125 days, and the latest in about 170 days in southern Louisiana. Grain types may be designated as short or pearl, medium, and long. Practically no pearl type rice is now grown in Louisiana. Medium-grain types may be further subdivided into large and small, and long-grain types into thick and slender. A new intermediate type, which is represented by two promising selections, mills much better than the ordinary long-grains while comparing favorably with them in appearance and quality. As indicated in Table 1, suitable varieties of some groups have not yet been developed. One of the goals of the breeding program is to develop varieties that conform to a few standard grain types, so that regardless of the maturity of the varieties grown, milled rice may be marketed on the basis of type alone.

Improved Characteristics Being Sought

Possible benefits from improved varieties include disease resistance, better adaptation for combine harvesting, increased yields, and wider choice of grain types and maturity. But it should be recognized that the benefits to be derived from such varieties may be nullified unless proper attention is given to pure seed, the control of red rice and other weeds, and good soil management practices.

The desirable characteristics that should be incorporated into a limited number of improved varieties may be outlined as follows:

A. Better adaptation to mechanical harvesting.
   1. Stiffer, shorter straw, more uniform height and ripening.
   2. Easy threshing by combines.
   3. Smooth hulls and leaves to reduce irritating dust.
   4. Grain shape suitable for easy drying.

B. Improved quality.
   1. For milling.
      a. Greater resistance to breakage in milling.
      b. Less tendency to produce pecky rice.
   2. For cooking, as to consumer preference.
      a. Moist, or slightly sticky, for general trade.
      b. Dry, or flaky, for fancy trade.

C. Improved yield.
   1. Better resistance to diseases.
   2. Increased percentage of filled grains (reduction of blank florets).
   3. Large panicles and heavier grain weight.

D. Improved seasonal distribution for harvest.
   1. Medium-grain varieties in different maturity groups.
   2. Long-grain varieties in different maturity groups.

Methods of Testing Varieties

As soon as promising uniform strains are recovered from crosses they are entered in nursery row tests for comparison with standard varieties of the same general type. These tests give sufficient information on time of maturity, height, strength of straw, yield and grain quality to eliminate many selections. Those that are retained undergo further preliminary testing and seed increase.

The most promising selections are entered in the regional uniform nurseries and tested at the three southern rice experiment stations. The superior selections are also entered in the field plot tests, which are, so far as possible, conducted under ordinary field conditions. There may be seed enough for only one plot the first year, but thereafter three or four plots of each variety are sown. The field plots are one drill strip in width, and usually about 150 feet in length, or about 1/40 to 1/30 of an acre, depending on the area available. The plots within a group are distributed at random over the experimental area in order to avoid the favoring of any variety by a superior location.

Field plot tests are organized into four groups on the basis of time of maturity. Typical standard varieties now used for comparison are Zenith and Magnolia in the early group, Bluebonnet and Fortuna in the early midseason group, Blue Rose in the medium late group, and Rexoro in the late group. About ten varieties and selections are included in each group.

Results of Plot Experiments

The yields from field plot tests are given in Table 2. Space does not permit detailed tabulation of the nursery yields. The varieties are grouped in Table 2 as they were in the tests. Yield data for eight years are available for 15 varieties, and data for three years for 11 newer varieties and selections are presented. Relative yields on a percentage basis are given for the same varieties in Table 3, in which yields from nursery and outfield tests in addition to those from field plots are included. Outfield tests are conducted in order to obtain information on the performance of varieties in the various parts of the rice area. These are conducted in nursery and drill strip plots, grouped as above but with fewer entries.

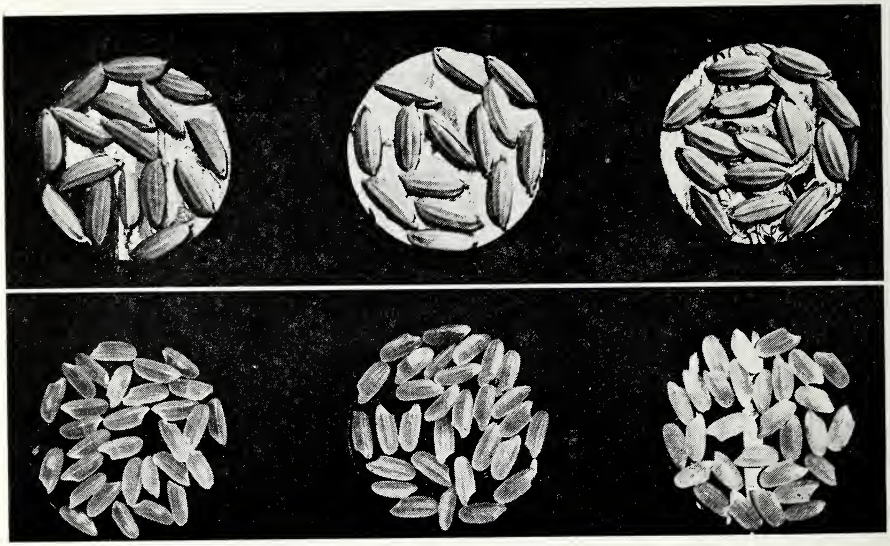
Variety Recommendations for 1949

The varieties recommended for growing in 1949 are the same as for 1948. Based on performance in field and nursery tests and availability of seed, the following varieties are recommended for Louisiana: early medium-grain—Zenith and Magnolia; early midseason long-grain—Bluebonnet, Fortuna and Nira; midseason medium-grain—Blue Rose and Blue Rose 41; and late long-grain—Rexoro and Texas Patna. These varieties also are listed on the inside cover page. Possibly the acreage sown to long-grain varieties will increase somewhat with a decrease in other types. In 1948, more than 50 per cent of the Louisiana acreage was sown to early medium-grain varieties, resulting in a glutted market early in the harvest season. If the acreage were properly adjusted among the different varieties, the seasonal marketing of the crop should be more orderly. The suggested adjustments are to reduce the Zenith acreage to about one-half that of last year, reduce Fortuna slightly, and offset these by increases in Magnolia, Bluebonnet, Texas Patna, Rexoro, and Nira. The acreage of Blue Rose might remain about the same as in 1948. The suggested proportions then would be Texas Patna and Rexoro about 25 per cent, Bluebonnet 20 per cent, Zenith 20 per cent, Blue Rose 12 per cent, Magnolia 10 per cent, Fortuna 10 per cent, and Nira 3 per cent.

Magnolia is easier to combine than Zenith, and although the latter may be slightly more productive, Magnolia has brought a price equal to or slightly higher than the best grades of Zenith.

Bluebonnet has failed to gain favor because pure seed has not been available and because poor stands often were obtained. Better seed of Bluebonnet is probably now available, and the use of seed treatments should ensure satisfactory stands. The yield of Bluebonnet is equal to that of Fortuna and the grain is less chalky.

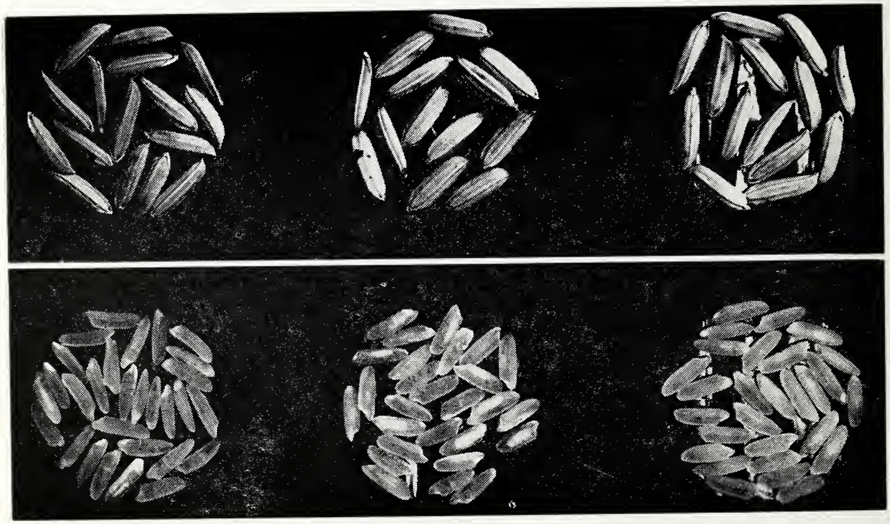
Rough and clean samples of eight standard varieties and four promising



ZENITH
C.I. 7787

MAGNOLIA
C.I. 8318

Lacrosse 250
C.I. 8985

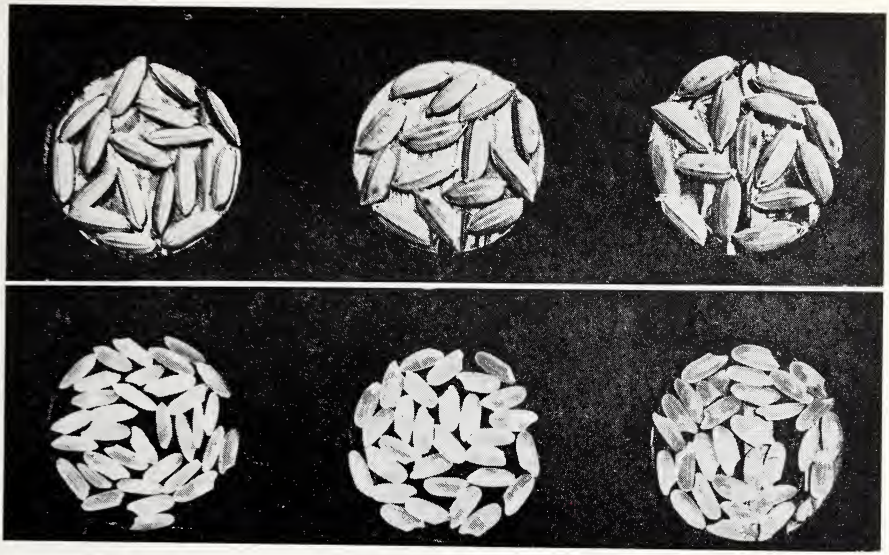


BLUEBONNET
C.I. 8322

FORTUNA
C.I. 1344

NIRA
C.I.2702

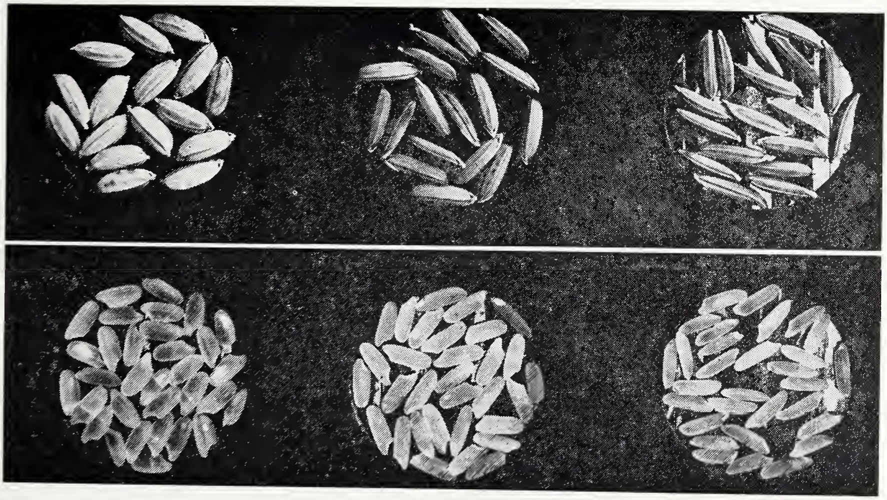
ections arranged in order of maturity. *(Photo by Dr. E. C. Tims.)*



REXORO x FORTUNA
C.I. 8987

IMPROVED BLUE ROSE
C.I. 2128

BLUE ROSE 41
C.I. 8317



(B.R.xREX.) x B.R.
6 1-25-12

REXORO x PURPLE LEAF
C.I. 8986

REXORO
C.I. 1779

white tip. [5]Threshing difficult or easy. [6]Pearl, medium, medium-long, large-long, and long-slender.
medium sticky, sticky, very sticky, medium flaky, or flaky. [9]Yield relative to the average yield of the tests.

Variety	C. I. *No.*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*Average*	
										8 Years	*3 Years*
Early Group											
Cody	8642	....	....	....	....	....	11.8	17.8	13.2	....	14.3
Sel. 252-1-2	....	....	....	....	....	....	16.3	21.2	14.8	....	17.4
Early Prolific	5883	10.7	11.6	13.0	12.2	12.9	12.9	18.9	14.7	13.4	15.5
Zenith	7787	10.5	14.2	10.8	12.6	11.8	14.1	15.3	14.3	13.0	14.6
Magnolia	8318	13.1	12.8	10.9	9.7	10.8	13.8	14.0	14.7	12.5	14.2
Lacrosse 250	8985	....	....	....	....	....	18.5	19.9	13.8	....	17.4
Prelude	8311	11.7	12.1	14.6	9.4	10.6	12.9	19.0	12.8	12.9	14.9
Early Midseason Group											
Caloro	1561–1	13.1	7.9	15.0	8.5	10.5	10.6	12.4	11.2	11.2	11.4
Rexark	8644	....	....	....	....	....	8.5	14.1	14.6	....	12.4
Bluebonnet	8322	17.1	8.9	14.5	10.4	8.2	15.9	15.1	12.2	12.8	14.4
Fortuna	1344	14.0	10.0	15.3	10.4	8.7	14.1	12.3	13.9	12.3	13.4
Sel. B34B40-9	....	....	....	....	....	....	11.8	10.9	11.1	....	11.3
Sel. 45-8134-9	....	....	....	....	....	....	11.0	13.9	13.1	....	12.7
Arkrose	8310	12.6	8.4	12.9	10.9	12.5	10.0	14.2	14.6	12.0	12.9
Sel. 322A6-23	8987	....	....	....	....	....	12.5	11.6	16.2	....	13.4
Acadia	1988	15.4	9.6	16.6	11.0	13.4	6.9	10.2	11.5	11.8	9.5
Nira	2702	14.7	4.6	14.8	10.7	9.2	12.9	12.1	8.7	11.0	11.2
Late Midseason Group											
Improved Blue Rose	2128	12.3	9.1	16.9	10.1	12.8	8.9	8.6	11.0	11.2	9.5
Blue Rose 41	8317	12.3	8.9	15.2	10.4	14.7	10.5	9.7	11.3	11.6	10.5
Sel. 3 I-9-2-4	....	....	....	....	....	....	17.5	15.3	16.9	....	16.6
Sel. 6 I-25-12	....	....	....	....	....	....	16.3	13.4	16.8	....	15.5
Late Group											
Sel. 3-72-3	8986	....	....	....	....	....	12.6	9.4	14.0	....	12.0
Texas Patna	8321	15.4	13.4	12.0	8.1	13.4	9.8	8.0	13.2	11.7	10.3
Sel. 7/8 Rex. 3-22	....	....	....	....	....	....	12.0	10.3	10.5	....	10.9
Delrex	8320	13.8	13.5	15.1	11.3	16.9	13.6	8.9	9.4	12.8	10.6
Rexoro	1779	16.2	13.8	11.5	7.5	6.3	11.4	9.2	14.2	11.3	11.6
AVERAGE										12.1	13.0
Difference for significance, 5% point										4.3	3.7

Table 3. Data and Characteristics for Comparison of 29 Varieties and Selections.

Variety and Cross	*C. I. No.*	*Re-leased from*	*Average Date*[3]		*Ht. in Inches*	*Diseases*[4]		*Hull Color*	*Pube-scence*	*Ease of thresh-ing*[5]	*Grain Type*[6]	*Milling*[7]		*Table Quality*[8]	*Yield in % of mean*[9]
			1st Panicle	*Mature*		*C.O.*	*W.T.*					*Total*	*Whole*		
Cody (Colusa x Lady Wright)	8642	Mo.	7/12	8/25	41	S	Tr	Straw	Hairy	Dif.	Pearl	112	101	S	99
Early Prolific	5883	[1]	7/15	8/25	47	S	S	Straw	Hairy	Dif.	M.L.	110	92	V.S.	102
Iola—B.R. x Shoemed-Fortuna Sel. No. 252-1-2	....	[2]	7/16	8/26	44	R	R	Straw	Smooth	Easy	M.L.	107	73	F	112
Magnolia (Imp. Blue Rose x Fortuna)	8318	La.	7/16	8/23	43	M	Tr	Straw	Hairy	Easy	M	112	93	S	96
Zenith (Sel. from Blue Rose)	7787	Ark.	7/18	8/24	43	S	M	Straw	Hairy	Dif.	M	110	90	M.S.	101
Lacrosse 250 (Colusa-Blue Rose x Shoemed-Fortuna)	8985	La.	7/24	9/6	42	M	Tr	Straw	Smooth	Dif.	M	109	85	S	116
Prelude (Imp. Blue Rose x Fortuna)	8311	Ark.	7/24	9/2	44	S	M	Straw	Hairy	Dif.	L.L.	107	78	M.F.	101
Caloro (Sel. from Early Wataribune)	1561–1	Cal.	7/27	9/8	41	S	M	Straw	Hairy	Dif.	Pearl	112	96	S	86
Hill Long Grain (Sel. from Rexoro)	....	[1]	7/29	9/6	44	S	R	Gold	Smooth	Easy	L.S.	107	61	F	77
Rexark (Rexoro x Supreme Blue Rose)	8644	Ark.	7/29	9/13	45	R	Tr	Gold	Smooth	Dif.	L.S.	107	65	M.S.	100
BR-Rex. x Rexoro Sel. No. 4-II-1-8	....	[2]	8/3	9/9	49	R	R	Straw	Smooth	Easy	L.S.	109	70	F	104
Bluebonnet (Rexoro x Fortuna)	8322	Tex.	8/3	9/9	47	M	R	Straw	Smooth	Easy	L.S.	109	66	F	100
Fortuna (Introduction)	1344	La.	8/7	9/14	50	S	R	Straw	Hairy	Easy	L.L.	110	73	F	103
Rexoro x Nira Sel. No. B34B40-9	....	[2]	8/7	9/14	46	R	R	Gold	Smooth	Easy	L.L.	109	77	F	96
Iola x Nira Sel. No. 45-8134-9	....	[2]	8/7	9/18	51	R	R	Straw	Smooth	Easy	L.L.	106	72	F	114
Arkrose (Caloro x Blue Rose)	8310	Ark.	8/7	9/16	47	R	S	Straw	Hairy	Dif.	M	112	98	S	99
Rexoro x Fortuna Sel. No. 322A6-23	8987	[2]	8/8	9/13	48	S	R	Straw	Hairy	Easy	M.L.	112	89	F	101
Kamrose (Kameji x Blue Rose)	8314	Ark.	8/8	9/16	46	R	Tr	Straw	Hairy	Dif.	M	113	99	S	104
Acadia (Sel. from Omachi)	1988	La.	8/10	9/21	43	S	M	Straw	Hairy	Dif.	Pearl	112	92	S	95
Nira (Introduction)	2702	La.	8/13	9/18	51	R	R	Straw	Smooth	Easy	L.L.	108	66	F	96
Improved Blue Rose	2128	[1]	8/17	9/24	48	S	S	Straw	Hairy	Dif.	M	112	96	S	97
Blue Rose 41 (Sel. from Imp. Blue Rose)	8317	La.	8/17	9/24	47	M	Tr	Straw	Hairy	Dif.	M	112	96	S	104
Blue Rose—Rex. x Blue Rose Sel. No. 3I-9-2-4	....	[2]	8/20	10/1	48	R	M	Straw	Smooth	Dif.	M	107	90	S	129
Rexoro x Purple Leaf Sel. No. 3-72-3	8986	[2]	8/23	10/2	47	S	R	Gold	Smooth	Easy	M.L.	112	90	F	94
B.R.—Rex. x Blue Rose Sel. No. 6-I-25-12	....	[2]	8/24	10/4	47	R	M	Straw	Smooth	Easy	M	109	80	S	107
Texas Patna (C. I. 5094 x Rexoro)	8321	Tex.	8/26	10/5	51	S	R	Gold	Smooth	Easy	L.S.	108	75	F	97
B. R.—Rex. x Rex. x Rex. Sel. No. 7/8 Rex.-3-22	....	[2]	8/28	10/9	42	R	R	Gold	Smooth	Dif.	L.S.	108	75	F	101
Delrex (Rexoro x Delitus)	8320	La.	8/29	10/9	53	R	R	Gold	Smooth	Easy	M.L.	109	75	F	97
Rexoro (Introduction)	1779	La.	9/1	10/11	49	S	R	Gold	Smooth	Easy	L.S.	108	69	F	92

[1] Released by commercial rice growers. [2] Experimental varieties, not released. [3] Average date of seeding, April 15. [4] *Cercospora oryzae* (long brown spot) and white tip. [5] Threshing difficult or easy. [6] Pearl, medium, medium-long, large-long, and long-slender. [7] Pounds total and whole (head rice) per barrel. [8] Cooking medium sticky, sticky, very sticky, medium flaky, or flaky. [9] Yield relative to the average yield of the tests.

Fortuna is a productive and widely adapted variety. It has become more subject to disease than formerly. Nira is as productive as Fortuna when good stands are obtained, and the grain is of better quality. Its resistance to disease is the best of any variety grown in Louisiana, but the plant is very tall and tends to lodge.

Blue Rose is still in favor for milling, but because of its susceptibility to diseases, weakness of straw, and difficulty in combining and drying, farmers have shifted to the early medium-grain varieties. Blue Rose 41 shows less white tip and leaf spot diseases, has a stiffer straw, and on the average appears to yield somewhat better than Improved Blue Rose.

Rexoro unfortunately has become very susceptible to the narrow brown leaf spot disease in recent years. Stem rot (crinkle) also often affects it. Texas Patna is subject to the same diseases and has a greater tendency to lodge, but competes better with grasses, matures about a week earlier, and may yield somewhat better than Rexoro.

Comparison of Varietal Characteristics

The more important characteristics of the varieties are listed in Table 3. The varieties are listed in order of maturity as indicated by the date of first emergence of the panicles from the boot. The number of days from first panicle emergence to maturity has averaged 39.5, but this differed among the varieties. Most of the tests were seeded during the month of April, so that the dates for first emergence of panicles and for maturity correspond to mid-April seeding.

The shorter-strawed varieties are ordinarily less likely to fall (lodge) than are the taller varieties, but the size of the culm is also an important factor in lodging.

The reaction to two diseases, Cercospora (narrow brown leaf spot) and white tip, are indicated in Table 3. All of the varieties now in commercial production are susceptible to Cercospora. When first grown most varieties apparently were resistant, but new races of the organism to which they are susceptible have arisen. White tip appears to some extent on the short and medium-grain varieties, but in Louisiana is seldom related to low yields except in Blue Rose.

Hull color and pubescence (hairiness of hulls and leaves) serve to differentiate varieties. Leaf and hull hairs result in a very irritating dust during harvesting and drying operations; thus the smooth-hulled varieties are much more desirable.

There is considerable difference in the tightness with which the grains are attached to the panicles. Varieties that thresh very easily are subject to loss by shattering when cut with a binder, while those that are tightly attached are usually difficult to thresh with a combine, especially if the straw is somewhat wiry.

Grain type is given as short or pearl, medium, medium-long, large-long, and long-slender. Practically no pearl type rice is now grown in Louisiana. The medium-grain types mill with less breakage than the long types, but the long-grain types are more attractive and usually bring a higher price. The available long-grain varieties are better suited to combine harvesting because they thresh easily and, having a smaller grain diameter, dry more readily. Milling quality indications are based on shelling tests conducted by the Federal-State Grading Office. This is expressed in total pounds of milled rice, and whole or head rice per barrel. The quality of the cooked rice is indicated as medium sticky, sticky, very sticky, medium flaky, or flaky. The short- and medium-grain varieties are usually somewhat sticky, whereas the long grains are usually flaky. Cooking quality is sometimes described as "moist" or "dry." There is a considerable demand for the slightly sticky or "moist" type in the South, but in other sections the flaky or "dry" type probably is preferred by consumers.

The data on yields on a percentage basis are given in Table 3. The percentage yield of each variety is based upon the average yields of all other varieties of the same type and maturity that were included in the same tests. Some selections were included in only six or seven tests, while upwards of 20 tests were made of others that were grown over the entire period.

Other Varieties

Several varieties, most of which are very productive under suitable conditions, are not generally recommended for production in Louisiana. Some are short-grain (pearl) types for which there is little demand, some are adapted to different growing conditions, and some might well be replaced with better-adapted, better-quality varieties of similar type which are already in production.

The pearl type Cody variety has become popular in northern Arkansas where it is adapted. Under Louisiana conditions, it begins to head earlier than Zenith and Magnolia but does not mature appreciably earlier and does not produce grain of a very good quality.

Early Prolific formerly was the only early-maturing variety in production. Zenith and Magnolia should replace it since they are equally productive and superior in quality.

Prelude is the leading long-grain variety in Arkansas. It has stiff straw but is rather difficult to thresh. It is earlier than Bluebonnet, but the latter is to be preferred owing to better quality.

The Hill Long-grain variey is slightly earlier than Bluebonnet and has good grain quality, but it is inferior in tillering capacity and in yield. It is easily drowned out by deep water applied at the first irrigation for the control of weeds.

Rexark is an early long-grain newly-released variety developed at the Stuttgart, Arkansas, station. In Louisiana, it ripens no earlier than Bluebonnet, has weaker straw, and is harder to thresh. Little or no seed is now available for growing in Louisiana.

Caloro is the principal variety grown in California, where it produces very high yields. In Louisiana, the yield is probably below that of other pearl varieties, and in common with other varieties of this type the grain tends to be chalky and pecky.

Acadia is a pearl variety similar to the old Wataribune. It is no longer grown commercially though it has been retained in the plot tests for comparison.

Asahi is a stiff-strawed variety, imported from Japan, that is no longer grown in Louisiana because of lack of demand for pearl type rices.

Calady is a medium-grain variety that matures somewhat earlier than Blue Rose. It is adapted to California conditions but is unsuited for growing in Louisiana.

Arkrose is an important medium-grain variety in Arkansas, where it is somewhat earlier and more certain than Blue Rose. It shows more white tip than does Blue Rose, but the yields from experimental plots compare favorably with those of Blue Rose. It is, however, weak-strawed and hard to thresh.

Kamrose is similar to Arkrose in grain type, has good disease resistance, and is perhaps more productive in Louisiana but is extremely difficult to thresh.

Delrex is a "scented" or "flavored" rice that was released from the Crowley station. A market for this type of rice has not been developed in this country, but some growers may be interested in producing small amounts for home consumption.

Some Promising New Varieties

Several selections are sufficiently promising to justify consideration for possible release as new varieties. Sel. No. 252-1-2 is an early smooth-hulled strain that has yielded well and ripens very uniformly. The grain type is intermediate between medium and long but the grain is probably too chalky.

Sel. No. 250-121 is outstanding for yield and strength of straw. The grain is of medium type. It is unusual in that although the grain is so tightly attached that there is no shattering in harvesting with a binder, it also combines very satisfactorily. Seed has been increased in quantities sufficient to sow more than 400 acres. This selection is being named and released as "Lacrosse 250."

Sel. No. 411-1-8 is a long-grain type maturing at the same time as Bluebonnet. The grain is somewhat clearer and more slender than that of Bluebonnet but the straw is probably not so strong.

Sel. No. B34B40-9 is a long-grain rice with stiff straw developed at the Beaumont, Texas, station. It matures about the same time as Fortuna and has a similar type of grain.

Sel. No. 45-8134-9 is a long-grain rice very similar to Nira but not so tall and probably is more productive.

Sel. No. 322A6-23 has an intermediate type of grain that in milling gives a higher percentage of head rice than do the commercial long-grain types. The milled product is very clear and attractive. It matures at the same time as Fortuna but has shorter straw. It appears to be especially well adapted to heavy soils.

Sel. 31-9-2-4 has given some of the highest yields obtained at Crowley from any variety. It is a smooth-hulled rice slightly later but very similar in plant and grain type to Blue Rose. It is very resistant to the narrow brown leaf spot disease and shows only a trace of white tip. The straw is slightly weak and the milling quality apparently is not quite equal to Blue Rose, but its superior yielding capacity may justify its release.

Sel. 61-25-12 matures at about the same time as Texas Patna. It has stiff straw, smooth hulls, and combines readily. The grain type is similar to that of Blue Rose but somewhat smaller. Several slightly different strains are being compared, and if any one of them proves as satisfactory for milling as it is for plant type, it may be released as soon as seed can be increased.

Sel. No. 3-72-3 is another selection with intermediate grain type and high mill yield of head rice. This selection has smooth hulls, stiff straw, and matures at about the same time as Texas Patna. It yields satisfactorily but unfortunately is susceptible to the narrow brown leaf spot disease and to straight head. Seed sufficient for sowing about 300 acres is available, and it is to be continued by cooperating farmers as an experimental variety.

136
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An Economic Study of the Dehydration of Sweet Potatoes for Feed in Louisiana

By

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TECHNOLOGY AND SCIENCE ROOM

LOUISIANA STATE UNIVERSITY

AND

AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION

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TABLE OF CONTENTS

INTRODUCTION 5

Purpose of Study 5

Sources of Information 5

NUMBER AND LOCATION OF DEHYDRATION PLANTS 6

DEHYDRATING OPERATIONS AND PRACTICES 8

Volume and Value of Production 8

Types and Sizes of Plants 8

Capital Investment in Dehydration Plants 9

Methods of Obtaining Ray Product 11

Disposal of Dehydrated Product 12

COSTS AND RETURNS FROM DEHYDRATING OPERATIONS 13

Costs 13

Returns 16

Most Profitable Method of Operation 16

FACTORS AFFECTING PLANT COSTS 17

Volume of Production 17

Length of Life of Dehydration Unit 20

Type of Fuel 21

Efficiency in Use of Labor and Equipment 23

Quality of Sweet Potatoes Processed 23

Conditions Necessary for Economical Operation 23

COMPARATIVE FEEDING VALUES AND COSTS OF SWEET POTATOES AND CORN 25

Feeding Value 25

Costs 26

SUMMARY 29

SELECTED REFERENCES 31

An Economic Study of the Dehydration of Sweet Potatoes for Feed in Louisiana

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INTRODUCTION

More than 50 sweet potato dehydration plants have been established in Louisiana in the last three years. These dehydrators enable farmers, shippers, and processors to dispose of those sweet potatoes that are undesirable for table stock or canning by converting them into a good carbohydrate feed for livestock. Dehydrated sweet potatoes compare favorably with corn in feeding value, are generally palatable to animals, and have desirable keeping qualities.

Market outlets for the entire crop is an important factor in the financial success of the sweet potato industry in Louisiana. A dependable outlet for low-grade sweet potatoes rests to a great extent upon the ability of dehydration plants to produce a feed that will compete in price with feeds of comparable feeding value.

Purpose of Study

This report presents an economic analysis of sweet potato dehydration operations in Louisiana for the 1946-47 and 1947-48 seasons. The extent of sweet potato dehydration in the state, practices of dehydrator operators, processing costs and returns, factors affecting dehydration costs, and comparative costs and feeding values of dehydrated sweet potatoes and corn are discussed. Such information should lead to a better understanding of the position of dehydration plants in the Louisiana sweet potato industry and provide a basis for making decisions by those interested in the continued prosperity of the industry.

Sources of Information

The detailed analysis of sweet potato dehydration operations presented in this study is based on the records of 31 dehydration plants in 1947 and 21 in 1948. Records were obtained from all plants in the state in 1947; however, many plants had had only limited experience and only about half of the 1946-47 records were used in analysis. The second year's study was made to verify costs and other results of the analysis made for the 1946-47 season.

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*The authors wish to express their appreciation to Professors B. M. Gile, Julian C. Miller, Wiley D. Poole, and F. D. Barlow of the Louisiana Agricultural Experiment Station for their many helpful suggestions in the preparation of this report. Mr. Ford, who conducted the initial phases of this study, is now Associate Agricultural Economist of the Georgia Agricultural Experiment Station.

Other data presented in this report are from published statistics, Experiment Station publications, and interviews with members of the sweet potato industry in the state.

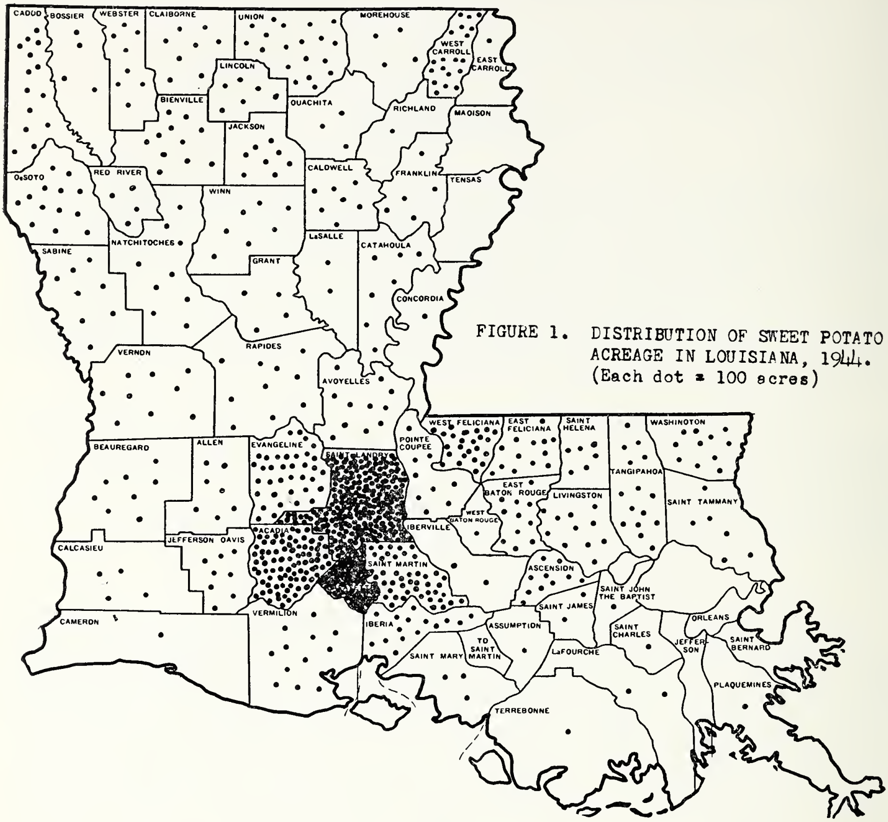

FIGURE 1. DISTRIBUTION OF SWEET POTATO ACREAGE IN LOUISIANA, 1944. (Each dot = 100 acres)

NUMBER AND LOCATION OF DEHYDRATION PLANTS

There were 62 dehydration plants in Louisiana in 1948 (Figure 2). Fifty-two of these were sweet potato processing plants, eight were exclusively for forage crops, one was used to dry tung-oil mill waste, and one was used to dehydrate sea food packing plant waste. Five sweet potato plants were also equipped to handle forage crops. Fifty-four dehydrators processed sweet potatoes in the 1946-47 season and 47 plants were in operation in 1947-48. Seven sweet potato dehydrating plants changed ownership in 1947 and 1948; however, two of these were purchased by Louisiana firms and continued operating in the state.

Twenty-two sweet potato dehydrating plants, or more than 40 per cent of the state's total, are located in the South Louisiana com-

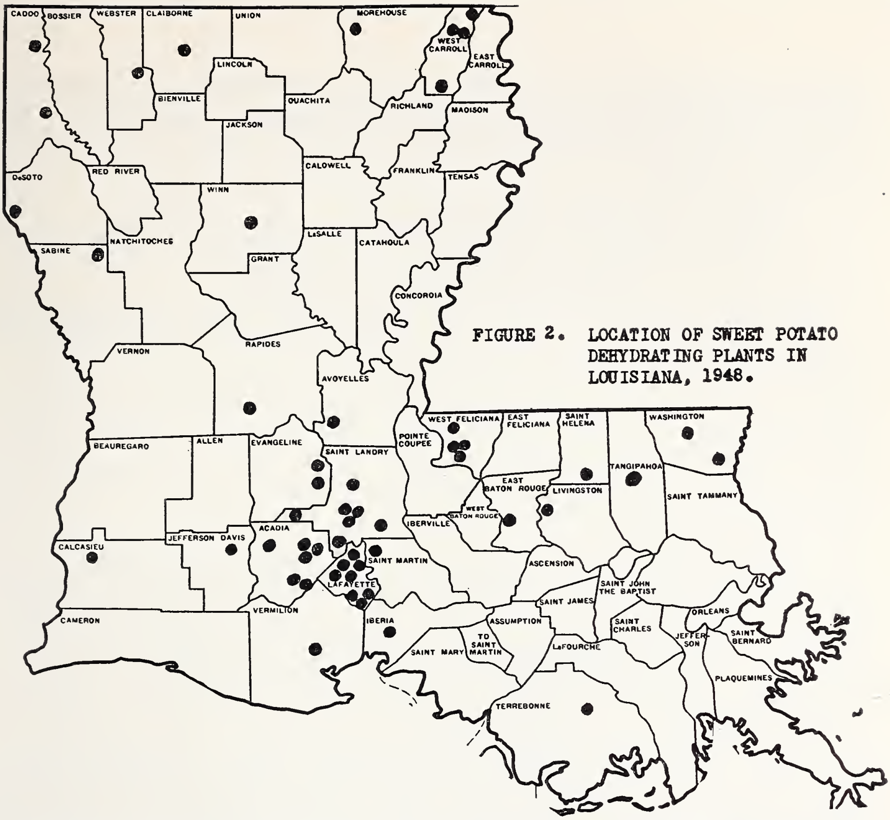

FIGURE 2. LOCATION OF SWEET POTATO DEHYDRATING PLANTS IN LOUISIANA, 1948.

TABLE 1. Number and Location of Sweet Potato Dehydrating Plants in Louisiana, 1948

Location	Number of plants	Location	Number of plants
Arnaudville	1	Independence	1
Bains	1	Kilbourne	1
Baptist Academy	1	Lafayette	4
Baton Rouge	1	Lawtell	1
Belcher	1	Lewisburg	1
Bogalusa	1	Logansport*	1
Breaux Bridge	1	Minden	1
Bunkie	1	Montpelier	1
Cankton	1	New Iberia	1
Carencro	2	Oak Grove	2
Chataignier	1	Opelousas*	1
Church Point	3	Pleasant Hill	1
Denham Springs	1	Rayne	2
DeQuincy	1	Scott*	1
Duson	1	Shreveport	1
Elton	1	St. Francisville	3
Epps	1	Sunset	2
Erath	1	Ville Platte	1
Eunice	1	Vidrine	1
Franklinton*	1	Winnfield	1
Glenmora	1		
Homer	1		
Houma	1		

*The dehydrating plants at Franklinton and Logansport were sold in 1948 and will not operate during the 1948-49 season. Plants were established at Opelousas and Scott after the close of the 1947-48 operating season and will process sweet potatoes in the 1948-49 season.

mercial producing area (St. Landry, Acadia, and Lafayette Parishes). The remaining sweet potato dehydrators are fairly well distributed over the state. Forage dehydrators are located mainly in the Red River Delta Area.

DEHYDRATING OPERATIONS AND PRACTICES

Volume and Value of Production

Nine per cent of the 1946 Louisiana sweet potato crop and 10 per cent of the 1947 crop were dehydrated for feed (Table 2). About 974,000 bushels of sweet potatoes from the 1946 crop and 745,000 bushels from the 1947 crop were processed into 170,000 and 130,000 hundredweights of feed, respectively. The smaller volume dehydrated in the 1947-48 season was caused in part by a decrease in size of the total sweet potato crop from 10,800,000 bushels in 1946 to 7,470,000 bushels in 1947.

The estimated gross value of the feed obtained by dehydrating sweet potatoes amounted to $466,000 in the 1946-47 season and $442,000 in the 1947-48 season. The value of the 1947-48 season's production was proportionately higher than for the preceding season because of an increased demand for sweet potato feed and a smaller volume with which to supply it.

Sweet potatoes dehydrated are usually culls and weevil damaged potatoes mainly unsalable by farmers, shippers, and canners. Cannery waste is an important source of raw material for some dehydrators. A large proportion of the sweet potatoes processed would normally be lost because of decay, or rodent and weevil damage. Thus, dehydration has afforded the industry an income from a portion of the crop which often has proved troublesome and expensive to dispose of in the past. This new source of high quality carbohydrate feed has helped materially in reducing the deficit of feeds required in the state for its growing dairy and livestock industries. In addition, dehydrators aid greatly in the sweet potato weevil control program.

TABLE 2. Extent of Sweet Potato Dehydration in Louisiana, 1946 and 1947 Crops

	1946	1947
Total production of sweet potatoes in Louisiana (bushels)	10,800,000	7,470,000
Sweet potatoes dehydrated (bushels)	974,000	745,000
Per cent of total crop dehydrated	9	10
Dry material obtained (cwt.)	170,000	130,000
Estimated gross value (dollars)	466,000	442,000

Types and Sizes of Plants

The rated productive capacity of dehydration units in Louisiana ranges from 300 to 4,000 pounds of dehydrated material per hour.

All but seven of the units operating in the 1946-47 season had capacities of 600 to 800 pounds per hour. Two units had capacities of 2,500 pounds per hour, one was rated at 300 pounds, and another had a 450-pound capacity. The other three units had capacities of 1,000 to 2,000 pounds per hour. A plant having a productive capacity of approximately 4,000 pounds per hour was established in 1948. These very small and very large units were not included in the study since they were insufficient in number to permit an accurate analysis and appraisal of their operations.

Three of the plants studied in each of the two seasons were of the twin-unit type, having batteries of two dehydration units of the same type and size. The remainder of plants studied had single dehydration units of the same capacity. The dehydration units were powered by either electric motors or internal combustion engines run on natural gas or butane. Some of the plants used natural gas for furnace heat while others used butane or fuel oil, depending upon the availability of a particular type in the section where located.

Capital Investment in Dehydration Plants

The average capital investment per plant was $8,962 in 1946-47 and $8,241 in 1947-48 (Table 3). These figures represent an average of the beginning and ending values of buildings, land, and plant equipment for the two years. The lower average investment in 1947-48 mainly was because of the subtraction of two years' depreciation. The 1946-47 investment reflects depreciation for only one year.

The original cost was about the same for the plants studied in the two years, averaging $9,561 in 1946-47 and $9,977 in 1947-48. Plants producing more than 6,000 hundredweight had somewhat higher initial capital outlays because three of them were twin-unit plants.

Dehydration equipment and buildings constituted the major items of capital investment, amounting to about 69 per cent and 30 per cent, respectively, of the initial capital outlay. Plant equipment consists of the dehydration unit, scales, conveyors, washers, and other specialized equipment; however, some plants have little other than the dehydration unit and scales. The dehydration unit was the most expensive item of plant equipment, amounting in most cases to more than 90 per cent of the total equipment investment. Buildings generally were of adequate size to house the dehydration unit and provide storage space for dehydrated material.

Usually only a fraction of an acre of land was required for plant purposes and the investment in land amounted to only about one per cent of the total capital required to establish a dehydration plant.

TABLE 3. Original Cost and Average Capital Investment, Louisiana Dehydrating Plants, 1946-47 and 1947-48 Seasons*

	1946-47								1947-48***	
	Plants dehydrating**						All plants		All plants	
	Less than 2,500 cwt.		2,500-5,999 cwt.		More than 6,000 cwt.					
	Original cost	Value	Original cost	Value	Original cost	Value	Original cost	Value	Original cost	Value
	(Dollars per plant)									
Buildings	2,233	2,181	3,340	3,222	3,485	3,370	2,856	2,774	2,973	2,694
Land	104	104	100	100	113	113	106	106	114	114
Plant equipment	6,005	5,585	6,138	5,564	7,618	6,995	6,599	6,082	6,890	5,433
Total	8,342	7,870	9,578	8,886	11,216	10,478	9,561	8,962	9,977	8,241
Average production per plant (cwt.)	1,064		4,191		9,747		4,649		4,510	
Capital investment per cwt. (dollars)	7.40		2.12		0.98		1.93		1.83	
Number of plants	15		5		11		31		21	

*Average capital investment reflects one year's depreciation in 1946-47 and two years' depreciation in 1947-48.

**The original cost of plants producing more than 6,000 hundredweight was greater, mainly because three of these plants had two dehydration units.

***Similar relationships to those existing between plants producing different volumes in 1946-47 were apparent in 1947-48.

Methods of Obtaining Raw Product

Four methods are used by dehydrator operators to obtain sweet potatoes for processing (Table 4). These are: (1) sweet potatoes grown by the owner or company operating the dehydrator; (2) packing shed and cannery salvage operations—several dehydrators are operated by sweet potato shippers and canners who dehydrate potatoes not suitable for shipping or processing, or utilize cannery peelings and waste; (3) cash purchases of low-grade sweet potatoes from farmers and others for dehydration; (4) custom work done on either a toll or cash basis, generally for farmers. Practically all dehydrators used two or more of the above methods to secure raw material.

The greatest volume of processing done by dehydrators in the two years studied, 1946-47 and 1947-48, was on a cash-custom basis, amounting to 58.8 and 62.2 per cent, respectively, of the total volume processed by dehydrators. Cash-custom work usually cost the farmer one dollar per hundredweight of dry matter in addition to the cost of the sack, although a few dehydrators charged more. A relatively small proportion of sweet potatoes processed was on a toll-custom basis. Dehydrators usually retained one half of the dry matter as toll for work done on this basis. A few plants charged as toll as little as one-third of the dry matter processed.

Nine of the 31 plants studied in 1946-47 and 11 of the 21 plants in 1947-48 purchased low-grade sweet potatoes for dehydration. Cash purchases accounted for 18.4 per cent of the total volume processed

TABLE 4. Methods of Obtaining Sweet Potatoes for Processing, Louisiana Dehydrating Plants, 1946-47 and 1947-48 Seasons*

Methods of obtaining raw product	1946-47		1947-48	
	Number of plants	Per cent of total volume processed	Number of plants	Per cent of total volume processed
Company grown	6	2.7	5	1.5
Packing shed and cannery salvage	13	11.8	12	9.2
Purchases for dehydration	9	18.4	11	15.9
Custom work:**				
Toll	7	8.3	15	11.2
Cash	29	58.8	21	62.2
Total	31***	100.0	21***	100.0
Average volume dry material processed per plant (cwt.)	4,649		4,509	

*Based on operations of 31 plants in 1946 and 21 plants in 1947.

**The plants usually charged one half of the dry material for toll work and one dollar per cwt. for work done on a cash basis.

***Most plants used more than one method of obtaining raw sweet potatoes for processing.

in 1946-47 and 15.9 per cent in 1947-48. Thirteen plants in 1946-47 and 12 plants in 1947-48 dehydrated sweet potatoes salvaged from packing shed and cannery operations of shippers and canners. While sweet potatoes from this source constituted a relatively small part of the total volume processed, shippers and canners were able to solve a troublesome disposal problem by dehyrating sweet potatoes not suitable for shipping or canning. Company-grown sweet potatoes were of minor importance in the total volume processed. Only 6 of the plants studied in 1946-47 and 5 in 1947-48 grew sweet potatoes for dehydration, mostly in small quantities.

Disposal of Dehydrated Product

Farmers retained 64.0 per cent of the total output of dehydrators in 1946-47 and 68.1 per cent in 1947-48 (Table 5). The farmers' share of dehydrated sweet potatoes came from cash-custom and toll-custom dehydrator operations. In both years, cash-custom work made up the bulk of the farm share. Most farmers used their dehydrated sweet potatoes on the farm to feed their own livestock. Usually milk cows and beef cattle received the largest amounts; however, many farmers fed the dehydrated material to practically all classes of farm animals, including hogs, chickens, and work stock.

TABLE 5. Proportion of Dehydrated Sweet Potatoes Retained by Farmers and Plant Operators, 1946-47 and 1947-48 Seasons

	1946-47	1947-48
	(Per cent of total dehydrated)	
Farmers' share*	64.0	68.1
Plants' share**	36.0	31.9
Total	100.0	100.0

*Farmers' share comes from cash-custom and toll-custom operations. In both years cash-custom work made up the bulk of the farm share.

**Plants' share comes from packing shed and cannery salvage operations, purchases for dehydration, dehydration of company grown sweet potatoes, and toll-custom work.

The plant share represented sweet potatoes salvaged from shipping operations, purchased for dehydration or company grown, and a portion of sweet potatoes processed on a toll basis. The plants studied sold the largest part of their share in both 1946-47 and 1947-48. Sales amounted to 57.6 per cent of the plant share of sweet potatoes processed in 1946-47 and 87.3 per cent in 1947-48 (Table 6). Farmers, mainly dairymen, were the main buyers of sweet potato feed, purchasing directly from dehydrators 42.0 per cent of the plant share in 1946-47 and 48.6 per cent in 1947-48.

TABLE 6. Disposal of Plant Share of Sweet Potatoes Processed by Louisiana Dehydrating Plants, 1946-47 and 1947-48 Seasons

Method of Disposal	1946-47	1947-48
	Per cent of plant share	
Sales to:		
Farmers	42.0	48.6
Retailers	1.8	—
Wholesalers	3.2	25.8
Feed mills	7.7	7.5
Other	2.9	5.4
Total sales	57.6	87.3
Plant use*	16.3	12.7
Inventory at end of season	26.1	0
Total plant share	100.0	100.0
Average value of plant share (dollars per cwt.)	2.74	3.40

*A few plants were operated by dairymen or livestock producers who used part or all of the feed produced in their dehydrators for their own purposes.

The demand for dehydrated sweet potatoes by dairymen and feed dealers was greater in 1947-48 than in the preceding year. This is evidenced by the fact that the plants studied in 1946-47 had on hand at the end of the season an inventory of 26.1 per cent of the total plant share, while in 1947-48 all of the plant share was disposed of. Practically all plant managers reported that their supply of dehydrated sweet potatoes was much smaller than the demand in the 1947-48 season. Largely because of this increased demand, the average price received by plants in 1947-48 was $3.40 per hundredweight compared with $2.74 in 1946-47.

COSTS AND RETURNS FROM DEHYDRATION OPERATIONS

Costs

Total costs of operating dehydration plants averaged $6,924 in 1946-47 and $6,783 in 1947-48 (Table 7). Plant costs were divided into 5 categories: (1) general overhead, consisting of depreciation and other overhead costs, such as insurance, taxes, and office expenses; (2) operating costs, which includes labor, fuel for furnace heat, power, repairs, and other incidental operating expenses; (3) sweet potatoes purchased; (4) sacks purchased; and (5) interest.

Depreciation was the major cost item included under "general overhead." Depreciation was computed by the straight-line method and was based on the estimated life of plant buildings and equipment. Equipment depreciation figured largely in total plant depreciation since the average estimated length of life of the dehydration unit was only 7 years. The capital investment in buildings was considerably smaller than the investment in equipment, and the estimated length of life of buildings was 17 years. Since there was little difference in capital investment in plants producing small and large

TABLE 7. Costs and Returns From Dehydration Operations, Louisiana Dehydrating Plants, 1946-47 and 1947-48 Seasons

Items of costs and returns	1946-47				1947-48			
		Volume dehydrated				Volume dehydrated		
	All plants	Less than 2500 cwt.	2500-5999 cwt.	More than 6000 cwt.	All plants	Less than 2500 cwt.	2500-5999 cwt.	More than 6000 cwt.
	(Average dollars per plant)							
Returns:								
Value of plant share	4,539	1,221	3,939	9,336	4,891	1,725	6,221	7,367
Cash charges	2,760	598	2,436	5,855	3,076	1,103	2,171	6,108
Gross income	7,299	1,819	6,375	15,191	7,967	2,828	8,392	13,475
Costs:								
General overhead								
Depreciation	1,082	945	1,034	1,291	1,143	1,002	1,156	1,292
Other	533	316	493	846	562	342	590	770
Total	1,615	1,261	1,527	2,137	1,705	1,344	1,746	2,062
Operating costs:								
Labor	1,476	328	1,133	3,198	1,242	440	995	2,370
Fuel for heat	914	256	862	1,834	766	428	1,037	919
Power	125	60	160	198	124	69	192	127
Repairs	—	—	—	—	282	220	245	384
Other	41	6	—	109	35	29	46	31
Total	2,556	650	2,155	5,339	2,449	1,186	2,515	3,831
Sweet potatoes purchased	1,982	567	1,373	4,190	1,903	603	2,422	2,945
Sacks purchased	323	72	355	651	316	107	408	475
Interest	448	394	444	524	410	380	429	429
Total costs	6,924	2,944	5,854	12,841	6,783	3,620	7,520	9,742
Net income	375	-1,125	521	2,350	1,184	-792	872	3,733
Gain or loss per cwt. (dols.)	0.08	-1.06	0.12	0.24	0.26	-0.48	0.20	0.47
Number of plants	31	15	5	11	21	8	6	7
Cwt. dehydrated per plant	4,649	1,064	4,191	9,747	4,510	1,635	4,290	7,982

volumes, the average total depreciation cost for plants producing the greater volumes was only slightly higher than for plants operating to only fractional capacity. When computed on a per unit of output basis, depreciation cost per hundredweight of dehydrated sweet potatoes was considerably less for plants producing large volumes than for those with small outputs.

Labor was the largest cost incurred in the actual operation of dehydration plants, averaging $1,476 per plant in 1946-47 and $1,242 in 1947-48. Three men were usually required to operate the dehydration unit; however, some plants used only two men while others used four. Labor costs were considerably higher for plants producing large volumes because of the longer period operated during the season.

Fuel costs averaged $914 per plant in 1946-47 and $766 per plant in 1947-48. Plants used natural gas, butane gas, or fuel oil for heat, depending upon the availability of a particular type of fuel in the area. Natural gas was the cheapest fuel used and butane was the highest. The effect of the type of fuel used on fuel costs will be discussed in a subsequent section of this report.

Repair costs were negligible in the 1946-47 season since that year marked the first season's operation for practically all plants. The manufacturer guaranteed the units for a period of 6 months against defective material and workmanship, and as a result, repair costs for the first season's operation were not borne by the dehydrator operator. Repairs necessary to ready equipment for operation during 1947-48 were charged to that season's operation and averaged $282 per plant. Plants processing more than 6,000 hundredweight had somewhat higher repair costs than those processing lesser amounts because a fuller use of equipment resulted in greater upkeep requirements.

The cost of sweet potatoes purchased for dehydration averaged about $8.00 per ton in 1946-47 and $10.00 a ton in 1947-48. These costs include handling and hauling charges as well as the price of the sweet potatoes. Plant managers allotted costs on the same basis for sweet potatoes grown by the plant management and those salvaged from shipping operations. Total costs of sweet potatoes purchased averaged $1,982 per plant in 1946-47 and $1,903 in 1947-48.

Selling costs were small since sales and deliveries were made usually at the dehydration plant. However, if the dehydration industry continues to expand its operations, selling costs may become more important in the future. The costs of sacks for the plant share of the dehydrated sweet potatoes averaged $323 per plant in 1946-47 and $316 in 1947-48.

Interest was computed at five per cent of the average capital investment of the plants studied, and amounted to $448 per plant in 1946-47 and $410 in 1947-48.

Returns

Gross returns from dehydration operations averaged $7,299 per plant in 1946-47 and $7,967 in 1947-48 (Table 7). The most important source of income was sales and value of feed used by the company of the plant share of sweet potatoes processed. The other source of plant income was charges for cash-custom operations. Total returns exceeded total costs by $375 in 1946-47 and $1,184 in 1947-48.

Net income varied directly with the volume of operations. In both years the income of plants processing the largest volumes exceeded costs by the widest margins. Plants processing less than 2,500 hundredweight of dry material suffered losses amounting to $1,125 in 1946-47 and $792 in 1947-48, while plants processing 6,000 hundredweight or more realized net profits of $2,350 and $3,733, respectively. Although the volume of output was the most important factor affecting net income, it is significant that 15 of the 31 plants studied in 1946-47, and 8 of the 21 studied in 1947-48, processed less than 2,500 hundredweight of feed during the season's operations.

It is apparent that obtaining a large volume of output is a major problem facing many plants. In 1947-48, plants processing 6,000 hundredweight or more realized a net profit of 47 cents per hundredweight of output, while plants processing less than 2,500 hundredweight lost an average of 48 cents per hundredweight. The location with respect to a supply area is an important factor affecting the success of a plant in securing sufficient raw material to operate at or near capacity. Dehydrators located at the fringes of producing areas generally were forced to operate at only fractional capacity. The possibility of dehydrating forage crops to increase the volume of plant operations should not be overlooked in such cases.

Most Profitable Method of Operation

Most plants combined two or more methods of operation during both the 1946-47 and 1947-48 seasons. However, more than 50 per cent of the total volume of sweet potatoes dehydrated in both years was processed on a cash-custom basis. The cash-custom method of operation proved least profitable, returning a net gain of only 1.6 cents per hundredweight processed in 1946-47 and 8.4 cents in 1947-48

(Table 8). Net returns per hundredweight were greater in 1947-48 than in the preceding year because of a higher average charge to farmers for work done on this basis. One advantage to plant operators of cash-custom work is that they do not have to store and sell the dehydrated feed before being paid for their services, as is the case when sweet potatoes are processed on any other basis.

Toll-custom operations were most profitable in 1947-48, while the processing of sweet potatoes purchased by the plants for dehydration returned the largest net gain in 1946-47. However, work done on these bases was relatively small compared to the volume of cash-custom operations. Greater net returns for both toll-custom operations and the processing of sweet potatoes purchased were realized in 1947-48 than in 1946-47. Plants received a larger percentage of sweet potatoes processed on a toll basis in 1947-48, and the value of dehydrated sweet potatoes per hundredweight was higher.

It is possible that operations on a toll basis will increase while cash-custom work will decline, especially if the cash charge per hundredweight to farmers is increased by dehydrating plants. During the past few years of high prices many farmers have had a supply of ready cash with which to purchase supplies or use for other purposes. If prices for farm products decline, farmers may find it more convenient and less money will be involved if they have their sweet potatoes processed for a percentage of the dry material on a toll-custom basis rather than to pay a cash charge.

FACTORS AFFECTING PLANT COSTS

Volume of Production

It was clearly demonstrated by the study of dehydration operations during the 1946-47 and 1947-48 seasons that volume of production was the most important single factor affecting the cost of processing the amount of raw sweet potatoes required to make a 100-pound sack of feed. Although total plant costs were higher for plants processing large volumes, their cost per unit of output was much less than for plants with small volumes. Processing costs in 1946-47 varied from $0.82 per hundredweight for plants processing 6,000 hundredweight or more to $2.16 per hundredweight for plants handling less than 2,500 hundredweight (Table 9). The same relationship between volume and cost existed in 1947-48. Plants producing large volumes had per unit costs of about $0.80 compared with $1.78 for plants producing small amounts. The average cost per hundredweight for all plants was $0.99 in 1946-47 and $1.01 in 1947-48.

Overhead and interest costs per unit of output were affected to a

TABLE 8. Comparison of Costs and Returns of Sweet Potato Dehydrating Plants Obtaining Raw Materials by Different Methods, 1946-47 and 1947-48 Seasons

Item	1946-47			1947-48		
	Method of obtaining raw product			Method of obtaining raw product		
	Toll-custom	Cash-custom	Purchases*	Toll-custom	Cash-custom	Purchases*
Receipts per cwt. of feed:						
Value of plant share	$1.060	$——	$2.740	$1.610	$——	$3.400
Cash charges	——	1.009	——	——	1.096	——
Total receipts	$1.060	$1.009	$2.740	$1.610	$1.096	$3.400
Expenses per cwt. of feed:						
Cost of potatoes**	——	——	1.340	——	——	1.610
Sacks	——	——	.188	——	——	.220
Overhead	.348	.348	.348	.378	.378	.378
Operating	.549	.549	.549	.543	.543	.543
Interest	.096	.096	.096	.091	.091	.091
Total expenses	$0.993	$0.993	$2.521	$1.012	$1.012	$2.842
Net return per cwt.	$0.067	$0.016	$0.219	$0.598	$0.084	$0.558
Per cent of total volume processed***	8.3	58.8	30.2	11.2	62.2	25.1

*Purchases and packing shed salvage operations computed on same basis.

**Ratio of raw product to dry material was 3.15 pounds to 1.

***Small amounts were company-grown. See Table 3.

TABLE 9. Relation of Volume Dehydrated to Overhead and Operating Costs, Louisiana Sweet Potato Dehdyrating Plants, 1946-47 and 1947-48 Seasons

Cost item	1946-47				1947-48			
	Volume dehydrated				Volume dehydrated			
	All plants	Less than 2500 cwt.	2500-5999 cwt.	More than 6000 cwt.	All plants	Less than 2500 cwt.	2500-5999 cwt.	More than 6000 cwt.
	(Average dollars per cwt.)							
General overhead:								
Depreciation	.233	.888	.247	.132	.253	.613	.269	.162
Other	.115	.297	.118	.087	.125	.209	.137	.099
Total	.348	1.185	.365	.219	.378	.822	.406	.261
Operating costs:								
Labor	.317	.308	.270	.328	.275	.269	.232	.297
Fuel for furnace	.197	.240	.206	.188	.170	.263	.242	.115
Power	.027	.056	.038	.021	.028	.041	.045	.016
Repairs	—	—	—	—	.062	.135	.057	.048
Other	.008	.005	.000	.011	.008	.018	.011	.004
Total	.549	.609	.514	.548	.543	.726	.587	.480
Interest	.096	.370	.106	.054	.091	.233	.100	.054
Total costs	.993	2.164	.985	.821	1.012	1.781	1.093	.795
Number of plants	31	15	5	11	21	8	6	7
Cwt. dehydrated per plant	4,649	1,064	4,191	9,747	4,510	1,635	4,290	7,982
Plant investment (dollars per cwt.)	1.93	7.40	2.12	.98	1.83	4.65	2.00	1.09

greater extent by volume of production than were other processing costs. Depreciation, insurance, taxes, etc., were relatively fixed in amount for all plants regardless of production, and consequently were much smaller per unit of output for large producers than for small producers. While averaging about $0.38 per hundredweight for all plants in 1947-48, depreciation and other overhead costs varied from $0.26 per hundredweight for plants producing 6,000 hundredweight and more to $0.82 per hundredweight for plants producing less than 2,500 hundredweight. Interest was of minor importance in total processing costs per hundredweight for plants with large outputs but averaged $0.37 per hundredweight in 1946-47 and $0.23 in 1947-48 for plants producing less than 2,500 hundredweight.

Operating costs, consisting of labor, fuel, power, repairs, and other costs directly related to plant operations, were affected to a lesser extent by volume of production than were overhead costs. However, most items of operating costs varied somewhat with volume of output. Generally, there was a tendency for operating costs, exclusive of labor, to decline as the volume processed increased. Labor costs were highest for plants producing large volumes. Large plants frequently employ more men to operate the dehydration unit than do plants with small output. Operators of the small plants generally performed some of the labor necessary for operation, in addition to their supervisory work.

It appears highly probable that some dehydration plants, especially some of those out of the commercial sweet potato areas, will be forced to discontinue operations unless a volume of raw material sufficient to reduce costs and increase returns can be obtained. Shippers and processors who operate dehydrators in conjunction with packing shed and canning operations are in a relatively better position. Dehydrators in these cases alleviate a troublesome disposal problem and provide a means for an income-producing salvage operation. In addition, these dehydrators may bid for volume from other sources.

Length of Life of Dehydration Unit

Depreciation made up the bulk of overhead costs, and greatest reductions in overhead costs resulted from lower depreciation costs per unit of output. Most plant operators estimated the length of life of their dehydration unit at about 7 years. Because of the high initial cost of the dehydration unit and the relatively short expected life, equipment depreciation constituted the greater part of total plant depreciation. Many dehydrator operators have had insufficient time and experience on which to base their estimates of life expectancy of the dehydration units. The effect on costs of using life expectancies of 5, 7, and 10 years is shown in Table 10. Since depreciation was computed by the straight-line method, depreciation cost per unit of output decreased as the life expectancy of the unit increased. Conversely, interest which was figured at 5 per cent of the average capital investment each year increased as life expectancy increased. However, because depreciation costs are much greater than interests costs, total processing costs are smaller if the length of life of the dehydration unit is long. In 1947-48, total processing costs averaged $1.090 per hundredweight computed on a 5-year expected life basis, $1.012 on a 7-year basis, and $0.956 on a 10-year basis.

Type of Fuel

The type of fuel burned in dehydrator furnaces had an important effect on the fuel costs of dehydrating sweet potatoes. Natural gas was the most economical furnace fuel, costing much less than fuel oil or butane gas. While the average fuel costs per hundredweight of feed processed amounted to about $0.20 in 1946-47 and to $0.17 in 1947-48, those plants using natural gas had fuel costs of about $0.13 and $0.11, respectively (Table 11).

Next to natural gas, fuel oil was the cheapest fuel used. In 1946-47 and 1947-48, those plants using fuel oil had costs of about $0.22 and $0.28, respectively. Butane was the most expensive fuel, costing users about $0.39 per hundredweight of dry feed in 1946-47 and $0.56 in 1947-48. Considerably higher rates were charged for butane gas in 1947-48 than in 1946-47, although some plants were able to keep their old rates because of the large quantity used.

Most of the plants studied in both years were able to obtain natural gas; however, this fuel is unavailable in some areas and cannot be furnished at favorable rates in others. In such instances it may be to the advantage of plant operators to use fuel oil since it is also a relatively cheap fuel.

Plants with a large volume of output used fuel more efficiently than did low-volume plants, regardless of the type of fuel used. Economy in the use of fuel from high production results from the necessity of using relatively constant amounts of fuel to heat the dehydration furnace and tube, regardless of the rate of production. In 1947-48, plants producing more than 5,000 hundredweight of dry material had fuel costs of about $0.16 per hundredweight as compared with $0.21 for plants producing less than 5,000 hundredweight. A similar relationship existed in 1946-47.

TABLE 10. Relation of Different Life Expectancies of Dehydrating Plant Equipment to Depreciation and Interest Costs of Dehydrating Sweet Potatoes, 1946-47 and 1947-48 Seasons*

Length of life	1946-47			1947-48		
	Depreciation	Interest	Total processing costs	Depreciation	Interest	Total processing costs
	(Average cost per cwt.)					
7 years**	$0.233	$0.096	$0.993	$0.253	$0.091	$1.012
5 years	0.310	0.094	1.068	0.337	0.085	1.090
10 years	0.176	0.098	0.938	0.192	0.096	0.956
Cwt. dehydrated per plant		4,649			4,510	

*Depreciation was computed by the straight-line method and interest was based on 5 per cent of each year's average value of plant investment. Depreciation on this basis will be a constant total each year, while total interest charges will decrease as plant buildings and equipment depreciate. Interest and depreciation on buildings and interest on land are included in the figures above; however, only charges on plant equipment were computed using different life expectancies.

**The average estimated length of life of plant equipment was 7 years. Depreciation and interest charges used elsewhere in this report were computed on a 7-year basis.

TABLE 11. Relation of Types of Fuel Used for Furnace Heat to Fuel Costs, Louisiana Sweet Potato Dehydrating Plants, 1946-47 and 1947-48 Seasons

Type of fuel	1946-47				1947-48			
	No. of plants	Plants processing		All plants	No. of plants	Plants processing		All plants
		Less than 5000 cwt.	5000 cwt. or more			Less than 5000 cwt.	5000 cwt. or more	
		(Average cost per cwt. (dollars))				(Average cost per cwt. (dollars))		
Natural gas	21	.171	.121	.131	15	.131	.100	.107
Fuel oil	6	.274	.241	.244	4	.294	.270	.276
Butane*	4	.445	.369	.392	2	.612	.538	.562
All plants	31	.241	.187	.197	21	.210	.157	.170

*Higher rates were charged for butane in 1947-48 than in 1946-47.

Efficiency in Use of Labor and Equipment

The efficiency with which labor and equipment were utilized by plant managers materially affected the cost of producing a hundred-pound sack of feed. Those plants with the highest output per man-hour of labor and per hour operated had the lowest per unit labor and total costs (Table 12). By efficient operation a few plants with small production were able to compensate in part for lack of volume. Some plants producing large volumes further cut production costs by efficient utilization of labor and equipment.

In 1947-48, small-volume plants with outputs of 1.75 hundredweight or more of dry material per hour of labor had labor and total per unit costs of $0.214 and $1.395, respectively, as compared with labor costs of $0.335 and total costs of $1.746 for small-volume plants with outputs of less than 1.75 hundredweight per man-hour of labor. High-volume plants with outputs of 1.75 hundredweight or more per hour of man labor had total costs per unit of $0.815, compared with $0.866 for those high-volume plants which used labor less efficiently. Much the same relationship is shown when comparing costs of plants with large and small outputs per hour of operation of the dehydration unit.

Quality of Sweet Potatoes Processed

The type, size, quality, and condition of raw sweet potatoes processed have a considerable effect on the efficiency of dehydrator operation and also on the quality of the dry feed produced. More processing time is required for green and stringy sweet potatoes than for sound, dry potatoes. Decayed, dirty, or muddy sweet potatoes make a low-quality feed and may result in stoppages and breakdowns of the dehydration unit. It is important that sweet potatoes be clean before dehydration and that they be free from decay.

Conditions Necessary for Economical Operation

From the analysis of factors affecting the cost of dehydrating sweet potatoes, it appears that the following conditions are desirable for economical operation: (1) a large volume of sweet potatoes for processing to permit near capacity production; (2) the use of natural gas for furnace fuel, or fuel oil in those areas where natural gas is unavailable; (3) clean, dry sweet potatoes, free from decay; and (4) efficient use of labor and equipment. Labor efficiency is greatly increased when labor can be used full time by continuous operation of the dehydrator or in other work, such as in a storage house or packing shed. If a sufficient quantity of sweet potatoes is available, economies probably can be attained by the use of dehydrating units of large capacity.

TABLE 12. Relation of Operating Efficiency to Labor Costs and Total Processing Costs, Louisiana Sweet Potato Dehydrating Plants, 1946-47 and 1947-48 Seasons

Item	1946-47				1947-48			
	Plants processing				Plants processing			
	Less than 5000 cwt.		5000 cwt. or more		Less than 5000 cwt.		5000 cwt. or more	
	Labor costs	Total costs	Labor costs	Total costs	Labor costs	Total costs	Labor costs	Total costs
	(Average dollars per cwt. dehydrated)							
Dry material per hour of labor								
Less than 1.75 cwt.	0.309	2.010	0.347	0.864	0.335	1.746	0.321	0.866
1.75 cwt. or more	0.237	1.244	0.271	0.721	0.214	1.395	0.200	0.815
Dry material per hour plant operated								
Less than 6.0 cwt.	0.306	1.930	0.346	0.912	0.263	1.542	0.314	0.966
6.0 cwt. or more	0.207	1.091	0.301	0.719	0.253	1.497	0.261	0.783
Average cost of labor per cwt.								
All plants (dollars)	0.317				0.275			
Average output per hour of labor	1.47				1.66			
Average cwt. per hour operated	5.24				5.74			
Average wage rate per hour (dollars)	0.466				0.459			

COMPARATIVE FEEDING VALUES AND COSTS OF SWEET POTATOES AND CORN

Louisiana does not produce sufficient carbohydrate feeds for its growing dairy and livestock industries. Much has been said in recent years about the possibility of growing sweet potatoes as a feed crop to help overcome this deficit. A basic consideration in determining the feasibility of growing sweet potatoes as a feed crop is the relative costs of producing sweet potatoes and other carbohydrates of comparable feeding value.

At present corn is the main carbohydrate feed grown in the state, and most comparisons of the feeding efficiency and costs of production of sweet potatoes for feed have been made with those of corn.

Feeding Value

A comparison of the chemical composition of sweet potato meal and corn meal is shown in Table 13. The comparison is based on typical samples of meal ready for feeding.

The chemical analysis reveals that sweet potatoes furnish more carbohydrates and ash than corn, but are inferior in protein and fat content. Actual feeding tests made by Experiment Stations in various southern states have shown sweet potato meal to be about 90 per cent as efficient in feeding value as corn meal in dairy rations and in rations for fattening beef calves and steers.[1] Sweet potatoes

TABLE 13. Chemical Composition of Sweet Potato Meal and Corn Meal[1]

	Sweet potato meal	Corn meal
	Per cent	Per cent
Water	6.3	14.5
Ash	3.9	1.3
Crude protein	5.0	9.0
Crude fat	1.1	3.9
Crude fiber	3.7	2.4
Nitrogen-free extract	80.0	68.9
Total	100.0	100.0

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[1] For detailed results of Louisiana feeding experiments see: Seath, D. M., Rusoff, L. L., Miller, G. D., and Branton, Cecil, *Utilizing Sweet Potatoes as Feed for Dairy Cattle,* Louisiana Bulletin No. 423, Louisiana Agricultural Experiment Station, Baton Rouge, Louisiana, September 1947; and Berwick, Lee, *Dehydrated Sweet Potato Meal for Fattening Steers,* unpublished thesis, Louisiana State University, August 1948.

are an important source of vitamin A because of their high carotene content. Experimental results show that cows fed dehydrated sweet potato meal produce butter of a deeper yellow color and higher vitamin A content than cows fed yellow corn. Thus it appears that sweet potato meal compares favorably with corn in feeding efficiency. In the raw form about 3.5 bushels of sweet potatoes are equivalent in feeding value to one bushel of corn. Sweet potato vines make a high-quality roughage when cured, but so far they have not been utilized to any great extent.

Costs

The costs of producing sweet potatoes for feed, including a dehydration charge, and corn are shown in Table 14. These costs represent an average of findings in the St. Landry and Lafayette Parish sweet potato areas and the West Carroll area for the 1946 crop year.[2] The cost of producing a quantity of sweet potatoes equal in feeding value to one bushel of corn amounted to $2.19 compared with production costs of $1.24 per bushel of corn. It might be pointed out that

TABLE 14. Comparative Costs of Producing Sweet Potatoes and Corn on Selected Farms in Commercial Sweet Potato Producing Areas in Louisiana, 1946*

	Sweet Potatoes	Corn
Cost of man labor (per acre)	$36.27	$ 9.36
All other costs (per acre)	33.43	11.16
Total production costs (per acre)	$69.70	$20.52
Average yields (bu. per acre)	161	16.5
Cost of production per bushel	$ 0.43	$ 1.24
Bushels of corn equivalent**	46	16.5
Cost of production per bushel of corn equivalent	$ 1.52	$ 1.24
Dehydration cost per bushel of corn equivalent***	.67	——
Total cost per bushel of corn equivalent	$ 2.19	$ 1.24

*Based on an average of costs of production of sweet potatoes and corn in the St. Landry, Lafayette, and West Carroll commercial sweet potato areas as reported by Danielson and McCrory.

**About 3.5 bushels of raw Porto Rico sweet potatoes are equal in feeding value to one bushel of corn.

***The average charge to farmers for dehydrating sweet potatoes was $1.09 per hundredweight. About 5.7 bushels of the Porto Rico variety are required to furnish 100 pounds of dry matter. With the use of starch or feed varieties which average 37 to 40 per cent solids, it may be possible to reduce both production and dehydrating costs of a bushel of corn equivalent as much as 20 per cent because only about 4.7 bushels of raw sweet potatoes would be required to make 100 pounds of dry feed.

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[2] For detailed information see: McCrory, Eugene, *Management Problems Involved in the Organization and Operation of Farms in the Sweet Potato Area of St. Landry and Lafayette Parishes, Louisiana, 1946*, unpublished thesis, Louisiana State University, 1947; and Danielson, Carl B., *Enterprise Combination Problems Involved in the Management of Sweet Potato Farms in West Carroll Parish, Louisiana, 1946*, unpublished thesis, Louisiana State University, 1947.

these costs were incurred in areas where sweet potatoes are a major cash crop whereas corn is relegated to a secondary role. Sweet potato yields are considerably higher than the state average, while corn yields are only slightly greater than the average for the state as a whole.

Labor requirements for producing sweet potatoes are considerably higher than for corn. The cost of man labor necessary to produce an acre of sweet potatoes was $36.27 compared with $9.36 for corn on the farms studied. Both crops were produced mainly by hand methods and the use of mule equipment. Because of the nature of crops, about 125 hours of man labor were required to grow an acre of sweet potatoes, while corn needed less than 40 man hours.

In recent years, serious attempts have been made to adapt mechanized equipment for sweet potato transplanting and harvesting operations. By the use of transplanters, diggers, and tractor equipment a great reduction in hours of labor required for production may be realized. It is possible to reduce the man hours of labor necessary to produce an acre of sweet potatoes from 125 to about 45 by mechanizing operations (Table 15). The greatest reductions are possible in planting and harvesting. Labor requirements may be further reduced by eliminating the hoeing of sweet potatoes produced for stock feed. The elimination of this operation probably would not affect yields to a very large extent unless the amount of grass and weeds was sufficient to thwart early growth and development of the vines.

TABLE 15. Estimated Labor Requirements for Producing Sweet Potatoes in Louisiana Using Mechanized Equipment*

Operation	Man-hours per acre	Tractor-hours per acre
Plant production	4.3	—
Land preparation	2.1	2.1
Planting	9.0	1.3
Hoeing	12.0	—
Cultivation	2.4	2.4
Harvest	15.0	3.0
Total hours per acre using mechanized equipment	44.8**	8.8
Total man-hours per acre using hand methods and mule equipment	125	
Total mule-hours using hand methods and mule equipment	40	

*Based on unpublished data and estimates by agricultural engineers and farm management specialists of the Louisiana Agricultural Experiment Station.

**It may be possible to reduce further labor requirements if a more economical method of obtaining plant stands than by transplanting vines from beds is developed. Hoeing may not be necessary in many instances.

The effect of mechanization on the cost of producing sweet potatoes is shown in Table 16. Estimates of cost were made using different acreage and yield bases. The previous illustration of comparative costs of sweet potatoes and corn in Table 14 was based on an average acreage of 7.4 and an average yield of 161 bushels found on the farms studied. It is evident that acreages and yields of this size are insufficient to permit mechanization of operations because of the high cost of using specialized equipment. In fact, on such a small scale and low-yield basis, the use of hand methods and mule equipment results in production costs of $2.19 per bushel of corn equivalent, or 8 cents less than costs of mechanized operations.

TABLE 16. Estimated Costs of Production of Sweet Potatoes Using Mechanized Equipment Under Varying Acreage and Yield Bases, 1946 Price-Cost Conditions

	Basis of estimate			
	7.4 acres 161 bushel yield*	30 acres 161 bushel yield	30 acres 200 bushel yield	30 acres 300 bushel yield
	(Cost per acre)			
Man labor	$13.44	$13.44	$13.44	$13.44
Tractor use**	5.54	5.54	5.54	5.54
Equipment use***	42.03	10.37	10.37	10.37
All other costs	12.00	14.00	15.00	18.00
Total costs	$73.01	$43.35	$44.35	$47.35
Cost per bushel	$ 0.45	$ 0.27	$ 0.22	$ 0.16
Bushels of corn equivalent	46	46	57	86
Cost of production per bushel of corn equivalent	$ 1.59	$ 0.94	$ 0.78	$ 0.55
Dehydration cost per bushel of corn equivalent	$ 0.67	$ 0.67	$ 0.67	$ 0.67
Total cost per bushel of corn equivalent	$ 2.27	$ 1.61	$ 1.45	$ 1.22

*Average acreage and yield on sweet potato farms studied by Danielson and McCrory.

**Tractor costs based on data supplied by F. D. Barlow, Associate Economist, Louisiana Agricultural Experiment Station.

***Includes depreciation, interest, and upkeep on transplanter, vine cutter, and digger. Basic data for estimates supplied by Wiley Poole, Associate Agricultural Engineer, Louisiana Agricultural Experiment Station.

On larger acreages and yields, the costs of producing sweet potatoes probably would be materially reduced by the use of mechanized equipment. However, 30 acres of sweet potatoes with a yield of 300 bushels per acre produced under mechanized conditions may be required before costs of production, including a dehydration charge at present rates, are lowered below the cost of producing a bushel of corn grown mainly by hand methods on a small-acreage and low-yield basis. Not considered in these estimates is the possibility of improving corn production and reducing costs by use of hybrid seed, better cultural practices, and fertilization.

The dehydration charge is responsible to a large extent for the high cost of producing sweet potatoes for feed. The dehydration cost used is based on the cash charge for dehydration for cash-custom work which so far has barely covered the operating costs of dehydrating plants. It is uncertain whether average dehydration charges can be lowered very substantially in the future. One possible means of reducing these costs is through the pooling of sweet potatoes by a group of farmers to assure a large volume and efficient use of dehydration equipment. Efficient plants with large volumes in 1946-47 and 1947-48 processed 3.5 bushels of sweet potatoes, which is equivalent in feeding value to a bushel of corn, for less than $0.50 compared with $0.67 for all plants studied.

It appears from the preceding analysis that probably the major role of dehydration will, for some time, be of a salvage nature in the commercial production of sweet potatoes for table use and canning. When suitable sweet potato machinery is perfected and more economical methods of getting plant stands are developed, more farmers may be able to grow sweet potatoes for feed advantageously. But since mechanized equipment requires considerable investment, small growers may only be able to use it on a custom or cooperative basis. One advantage in favor of producing sweet potatoes for feed is that a greater volume of carbohydrate feed can be produced on a smaller acreage than in the case of corn. Also, in some areas the soil may be better adapted to the production of sweet potatoes.

SUMMARY

The 52 sweet potato dehydration plants established in Louisiana in the last three years enable farmers, shippers, and processors to dispose of sweet potatoes which are undesirable for table stock or canning by converting them into a good carbohydrate feed for livestock. About 9 per cent of the 1946 crop and 10 per cent of the 1947 crop of sweet potatoes were dehydrated for feed. Dehydration not only affords the sweet potato industry an income from a portion of the crop which often has proved troublesome to dispose of in the past, but in addition it helps to reduce the state's feed deficit and aids greatly in the sweet potato weevil control program.

A study of the operations of sweet potato dehydration plants in the 1946-47 and 1947-48 seasons showed that the following conditions are necessary for economical operation: (1) a large volume of sweet potatoes for processing; (2) the use of natural gas for furnace fuel, or fuel oil in those areas where natural gas is unavailable; (3) clean, dry sweet potatoes relatively free from decay; and (4) efficient use of labor and equipment.

The volume of sweet potatoes processed by dehydrating plants was the most important factor affecting both per unit operating costs and net income, mainly because some items of cost, such as depreciation, are relatively fixed in amount regardless of production. In 1947-48, plants processing 6,000 hundredweight or more of feed had an average net income of $3,733 per plant and operating costs of only $0.80 per hundredweight, while plants processing less than 2,500 hundredweight suffered losses amounting to $792 per plant and had operating costs of $1.78 per hundredweight of feed produced. Total costs for all plants averaged $0.99 per hundredweight of feed produced in 1946-47 and $1.01 in 1947-48. Of 31 plants studied in 1947-48, 15 processed less than 2,500 hundredweight of feed during the season. Location, with respect to a heavy producing area, is an important factor affecting the success of a plant in securing sufficient volume of raw material for efficient operation. Dehydrators located at the fringes of producing areas generally were forced to operate at only fractional capacity. In such cases, the possibility of dehydrating forage crops to increase the volume of plant operations should not be overlooked.

The rated productive capacity of most dehydrating plants in the state is from 600 to 800 pounds of dry matter per hour, although a few are larger and a few smaller. Most plants reported capital investment of from $9,500 to $10,000.

About two-thirds of the processing done by dehydrators in the two years studied was on a cash-custom basis whereby farmers delivered their sweet potatoes to the dehydrating plant and paid a fee of about one dollar for each 100 pounds of dry material received. Dehydrators also obtained raw materials for processing by cash purchases of low-grade sweet potatoes from farmers and others, from shipping and cannery salvage operations, by toll-custom work, and by growing their own sweet potatoes.

The dehydrated sweet potatoes retained by farmers were used on the farm to feed dairy cattle and other classes of livestock, including beef cattle, chickens, hogs, and work stock. Dehydrators sold their product mainly to dairymen, and to a lesser extent to feed dealers and feed mills.

Although dehydrated sweet potatoes compare favorably with corn and other carbohydrate feeds in feeding value, it is uneconomical at existing levels of production and dehydration costs for most farmers to grow sweet potatoes primarily as a feed crop. The major role of dehydration will continue for some time to be that of a salvage nature in the commercial production of sweet potatoes for table use. It is quite possible that with high-yielding feed varieties now available, improved machinery, and the development of more economical methods of securing plant stands, such as by planting small, whole potatoes or seed pieces, some farmers will be able to grow sweet potatoes for feed at an advantage.

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Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1946 and 1947

By

James P. Gaines and J. Norman Efferson

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TABLE OF CONTENTS

Page

INTRODUCTION 7

Procedure 7

TRENDS IN PRODUCTION, COSTS AND ORGANIZATION, 1938-1947 8

Changes in Volume of Business and Yields, 1938-1947 8

Trends in Costs, Returns, and Earnings 9

Organization Changes over the 10-Year Period 10

Tenure and Capital Investment, 1938-1947 11

FARM ORGANIZATION AND EARNINGS, 1938-1947 11

Farm Organization, 1946-1947 12

Costs and Returns, 1946-1947 13

MAJOR AND MINOR FACTORS AFFECTING PROFITS ON FAMILY-TYPE SUGAR CANE FARMS 13

Major Factors Affecting Farm Profits 15

Minor Factors in the Organization and Operation of Family-Type Farms 18

SUMMARY 31

APPENDIX 33

LIST OF TABLES

Table Page

1. Number and Size of Family-Type Sugar Cane Farms Surveyed in the Louisiana Sugar Cane Area, 1938-1947 8
2. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 9
3. Costs and Returns per Ton of Cane Sold for Family-Type Sugar Cane Farms in Louisiana, 1938-1947 10
4. Costs and Returns for Family Farms in the Louisiana Sugar Cane Area for the Ten-Year Period 1938-1947 12
5. Average Size and Yield and Other Related Information for Family-Type Sugar Cane Farms in Louisiana, 1946-1947 13
6. Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1946 and 1947 14
7. Relation of Size and Yield to Organization and Earnings of 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 15
8. Relation of Specialization in Cane Production to Earnings for 503 Family Farms in the Louisiana Sugar Cane Area, 1946 17
9. Relation of the Output per Worker to Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 18
10. Relation of Age of Farm Operators to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 19
11. Relation of Age of Farm Operators to Farm Earnings When the Influence of Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 20
12. Relation of Education of Farm Operators to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 21
13. Relation of Education of Farm Operators to Farm Earnings When the Influence of the Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 22
14. Relation of Race to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 23
15. Relation of Race to Farm Earnings When the Influence of Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 24

16. Relation of Tenure to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 25

17. Relation of Tenure to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 26

18. Relation of Size of the Farm Family to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 27

19. Relation of Size of the Farm Family to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 28

20. Relation of Degree of Mechanization to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 29

21. Relation of Degree of Farm Mechanization to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 30

LIST OF APPENDIX TABLES

Table Page

1. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 33

2. Costs and Returns per Acre of Cane Grown on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 33

3. Average Labor Returns to the Operator from the Sugar Cane Enterprise for Family-Type Sugar Cane Farms in Louisiana, 1938-1947 34

4. Tenure of Farm Operators Surveyed, Family-Type Louisiana Sugar Cane Farms, 1938-1947 34

5. Livestock and Equipment on Family-Type Louisiana Sugar Cane Farms, 1942 and 1946 35

6. Distribution of Capital Investment on Family-Type Sugar Cane Farms in Louisiana, 1942, 1945, 1946 and 1947 36

7. Cost of Tractor Work on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 36

8. Costs of Operating Farm Trucks on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 37

9. Costs of Operating Farm Automobiles on Family-Type Sugar Cane Farms in Louisiana, 1938-1947 37

10. Relation of Size of Farm to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana 38

11. Relation of Yield per Acre of Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana 39

12. Relation of Output per Worker to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana 40

13. Relation of Proportion of Cropland in Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana 41

14. Relation of the Combined Effect of Superiority in Size, Yield, Intensity of Cane Enterprise, and Labor Efficiency to Returns from Farming, Louisiana Family-Type Sugar Cane Farms, 1944 and 1946 42

15. Relation of Race and Tenure to Farm Earnings and Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 42

16. Relation of Parish of Residence to Farm Earnings and Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946 43

Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1946 and 1947

By

JAMES P. GAINES AND J. NORMAN EFFERSON

INTRODUCTION

In most years since 1938, the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station has conducted detailed farm management and cost studies of family-type sugar cane farms in Louisiana.[1] Extensive and intensive examination of this reservoir of economic data has resulted in the discovery of many facts of great importance to the Louisiana sugar cane industry. Continuous study of these farms permits verification of facts already discovered, the discovery of other facts, the observation of trends in costs and earnings, and the changes in farm organization and practices that are of significance to the industry.

The purpose of this report is to reveal trends in earnings, costs, and organization that have become apparent; present a detailed analysis of the financial status of the farms for the two most recent years, 1946 and 1947; summarize important facts that have been discovered and verified; and present the most recent facts that have been obtained.

Procedure

The basic data for these studies were collected by the survey method from cooperating farmers. Each year the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. Many of the same farms that were scientifically selected for the first study in 1938 have been studied in succeeding years. In cases where the original cooperators were not available, the adjacent farms were included so that continuity of the data and size of the sample could be maintained.

Each producer selected for the sample was visited by a trained enumerator who collected from the farmer the detailed results of his previous year's farming operations, including expenses, receipts, practices, and capital changes. As few of the small farmers keep detailed financial records, the information came largely from their memories, supplemented by bills and receipts that had been kept.

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[1] *A Farm Management and Cost Study of 500 Family-Sized Farms in the Louisiana Sugar Cane Area, 1938* (Louisiana Experiment Station Bulletin No. 314, February 1940); *Costs and Returns from 453 Family-Sized Sugar Cane Farms in 1940* (Department of Agricultural Economics Mimeographed Circular No. 25, March 1942); *Economic Aspects of Sugar Cane Production in Louisiana, 1941* (Dept. of Agricultural Economics Mimeographed Circular No. 26, June 1942); *Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945* (Louisiana Experiment Station Bulletin No. 420, June 1947); *A Study of Major and Minor Factors Affecting Management and Returns on Family Farms in the Sugar Cane Area of Louisiana* (Dept. of Agricultural Economics Mimeographed Circular No. 86, September 1948).

In all years except 1943 and 1944, the farms studied comprised from 5 to 10 per cent of the total number of farms in the Louisiana Sugar Cane Area. The original sample was weighted in accordance with the importance of the sugar cane enterprise in each parish so that the data were representative of the area as a whole.

TRENDS IN PRODUCTION, COSTS AND ORGANIZATION, 1938-1947

Farm organization and operation change with technological advancements, biological discoveries, and changing economic conditions. Changes in farm organization and operation cause farm costs and farm earnings to vary. Therefore, most production and cost trends can be associated directly with economic, technological, or biological developments. Changes are not the result of the whims of individual farmers. In examining sugar cane production and cost tendencies, and changes in farm organization, the underlying physical and economic causes were sought.

Changes in Volume of Business and Yields, 1938-1947

From 1938 to 1944, the average size of the farm business in the sugar cane area varied slightly from year to year but displayed no tendency to follow any particular pattern (Table 1). Since 1944, however, there is an indicated trend toward small acreages in cane and reduced acreage in total crops. The reduction of acres in total crops has been greater than that of cane so that there has been a slight increase in the percentage of cropland planted in sugar cane. This trend toward a smaller volume of business was due apparently to the shortage of available hired labor during the war years, which caused producers to reduce acreages in line with the reduced supply of hired labor and family labor.[2]

Annual variations in sugar cane yields followed no particular pattern (Table 1). When climatic conditions were favorable, yields were high; conversely, when climatic conditions were unfavorable, yields were low. Over the ten-year period, average yields were 19 tons of cane per acre.

TABLE 1. Number and Size of Family-Type Sugar Cane Farms Surveyed in the Louisiana Sugar Cane Area, 1938-1947

Item	1938	1940	1942	1943	1944	1945	1946	1947
Number of farms	500	453	467	110	110	508	503	500
Acres of cane per farm	41	35	35	44	42	32	25	26
Total acres in crops per farm	86	85	73	91	85	70	54	54
Yield of cane per acre	22	14	17	23	22	23	18	18
Tons of cane sold per farm	835	460	605	937	841	691	431	435

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[2] *Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945*, Louisiana Experiment Station Bulletin No. 420, June 1947.

Trends in Costs, Returns, and Earnings

Costs, returns, and earnings have increased greatly since 1938. This was expected and can be directly related to changes in the general price level. However, the significant point is not the amount but the degree of change and relative variations of the different cost and return items and measures of income.

Although average size of the farm business has declined in recent years, all farm expenses except hired labor and miscellaneous expenses have tended to increase (Table 2). The increases are due to an economic factor — general price level. The decrease in hired labor expenses can be attributed partly to the decline in size but more to a technological improvement — the advent of the tractor and increased farm mechanization. The percentage of farms having tractor power increased from 17 per cent in 1938 to 50 per cent in 1947. In 1938, hired labor constituted 43 per cent of total farm expenses, and in 1947, only 28 per cent. The tremendous increase in machinery costs can be attributed to increased farm mechanization. The miscellaneous expenses have declined because they include many incidental items that are associated with mule farm-

TABLE 2. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Item	1938	1940	1942	1943	1944	1945	1946	1947
				Dollars				
Farm Receipts:								
Cane sold for sugar*	3,075	1,689	3,169	5,407	5,524	4,840	3,273	3,709
Other crops sold	332	234	399	246	662	617	392	460
Livestock & livestock products	81	96	80	70	74	61	64	86
Other income	—	164	163	209	177	303	84	117
Total receipts	3,488	2,183	3,811	5,932	6,437	5,821	3,813	4,372
Farm Expenses:								
Hired labor	1,545	1,008	1,202	2,288	2,244	1,797	1,067	1,027
Unpaid labor**	208	215	266	340	312	286	224	339
Fertilizer	131	140	151	235	280	218	193	226
Feed, seeds, and plants	79	100	108	145	141	97	148	170
Machinery & building costs	280	270	332	445	542	611	687	750
Land rent***	283	195	354	574	585	585	452	498
Interest***	410	418	364	494	669	568	373	406
All other expenses	633	440	517	497	693	777	270	234
Total expenses	3,569	2,786	3,294	5,018	5,466	4,939	3,414	3,650
Income:								
Labor income	—81	—603	517	914	971	882	399	722
Value of farm privileges	321	343	510	530	763	696	537	693
Labor earnings	240	—260	1,027	1,444	1,734	1,578	936	1,415
Value of operator's time	430	550	654	671	1,105	893	770	737
Return to capital	—101	—735	+227	+737	+535	+557	+2	+391
Capital investment	8,200	8,360	7,280	9,880	13,380	11,360	7,460	6,927

*Total receipts from cane sold, including government payments.

**Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

***Includes rent at actual cost and interest on owned investment at 5 per cent of the depreciated assets.

ing; the trend has been toward fewer mules and more tractors. Land rent did not increase as rapidly or as much as did other expenses because it is not affected by changing prices as much. Interest and depreciation tend to be relatively fixed with regard to general price level and vary with the size of the capital investment.

Sugar cane receipts are affected by variations in size and yield so greatly that no significant pattern can be determined from the "average per farm" data. Returns per ton of cane sold, however, increased 131 per cent — from $3.68 to $8.51 per ton (Table 3). As total expenses increased only 86 per cent over the corresponding period, profits per ton of cane sold increased considerably. This is a familiar situation characteristic of agricultural price patterns of past decades. During inflationary periods agricultural prices rise faster than costs and farmers are relatively prosperous; during price recessions, agricultural prices drop more rapidly than costs and farmers are not very prosperous. Preliminary information for 1948 shows that sugar cane prices have receded significantly but that costs have remained at very nearly the same level. All available data indicate that sugar cane farmers should expect net returns to start declining soon and should make future plans with that in mind.[3]

Organization Changes over the 10-Year Period

The most significant change in the capital organization of sugar cane farms has occurred in the type of power employed. Only 85 of 500

TABLE 3. Costs and Returns per Ton of Cane Sold for Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs and Returns per Ton Sold	1938	1940	1942	1943	1944	1945	1946	1947
				Dollars				
Direct farm expenses	3.44	4.72	4.26	4.22	4.89	5.48	6.01	6.31
Rent and interest	.83	1.33	1.19	1.14	1.46	1.67	1.91	2.07
Total farm expenses	4.27	6.05	5.45	5.36	6.35	7.15	7.92	8.38
Receipts from sources other than sugar cane	.49	1.14	1.06	.56	1.06	1.42	1.25	1.53
Net cost of producing sugar cane	3.78	4.91	4.39	4.80	5.29	5.73	6.67	6.85
Total returns from cane sold	3.68	3.67	5.24	5.77	6.41	7.00	7.60	8.51
Profit from sugar cane to pay operator for his labor	—.10	–1.24	.85	.97	1.12	1.27	.93	1.66
Value of farm privileges	.38	.74	.84	.57	.88	1.00	1.24	1.59
Total cash and non-cash profits from sugar cane	.28	—.50	1.69	1.54	2.00	2.27	2.17	3.25
Value of operator labor	.51	1.20	1.08	.72	1.28	1.29	1.79	1.69
Capital investment per ton	9.82	18.17	12.03	10.54	15.90	16.44	16.08	14.77
Tons of cane produced per farm	890	521	661	1,005	890	727	464	469
Tons of cane sold per farm	835	460	605	937	861	691	431	435

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[3] Related Costs and Income data for the 10-year period may be found in the Appendix.

farms studied in 1938 had tractors and tractor equipment as compared with 250, or one-half of farms studied in 1947 (Appendix Table 7). All farms still had mules in 1946, as tractors are not practical for all operations on small farms. However, most farms with tractors had more mules and mule-drawn equipment than were necessary to take care of incidental jobs. Many farmers reported that they kept mules and equipment for sentimental reasons only. Any farm resource which is not used much or is not necessary should be disposed of because it impairs efficiency, increases costs, and reduces profits.

The number of automobiles, trucks, and other livestock remained at the same approximate level (Appendix Table 6).

Tenure and Capital Investment, 1938-1947

There have been some changes in farm tenure in the area since 1938. Full owners have increased slightly in number, part owners have declined, cash renters have remained at the same level, and share renters have increased in number. Apparently many part owners have become full owners (Appendix Table 4).

Average farm capital has dropped somewhat, probably because of the decline in size of the farm business that has taken place in the past few years (Appendix Table 6).

FARM ORGANIZATION AND EARNINGS, 1938-1947

In Table 4, average receipts, expenses, income, and size for the farms studied over the ten-year period are presented. The data represent a simple average for the ten years rather than a weighted average. A weighted average would tend to overemphasize the results of years when a relatively large number of records were used.

Over the ten-year period, receipts from the sugar cane enterprise constituted 86 per cent of total farm returns. Sales of other crops represented 9 per cent and livestock and livestock product sales only 2 per cent of total receipts. These data are indicative of the highly specialized nature of farming within the area.

Labor expenses, hired and family, made up 45 per cent of total farm expenses. Fertilizer purchases comprised only 5 per cent and feed and seed only 3 per cent of total farm expenses.

The average price received for cane sold from 1938 to 1947 was $5.96 per ton. Average annual gross income amounted to $4,508 per farm, or $6.96 per ton of cane sold. Over the period, average expenses were $4,049 per farm, or $6.22 per ton of cane sold.

Labor income, which is the return to the operator for his labor and management, averaged $459 per farm, or $0.74 per ton of cane sold. If the value of products used from the farm for home consumption is included as income, average income was $1,004, or $1.60 per ton of cane sold. This means that family-type sugar cane farmers had an average combined cash and non-cash income of $84 per month for the 1938-47 period.

Over the same period, money invested in sugar cane farms returned an average of only 2 per cent annually. At that rate, it would take the average family sugar cane farm 50 years to pay for itself.

TABLE 4. Costs and Returns for Family Farms in the Louisiana Sugar Cane Area for the Ten-Year Period 1938-1947

Costs and Returns	Average for the 10-Year Period			
	Per Farm	Per Acre of all Crops	Per Acre of Cane	Per Ton of Cane Sold
	Dollars			
Farm Receipts:				
Cane sold for sugar*	3,859	51.54	110.35	5.96
Other crops sold	417	5.63	12.05	.65
Livestock & livestock products	77	1.03	2.21	.12
Other income	155	2.02	4.34	.23
Total receipts	4,508	60.22	128.95	6.96
Farm Expenses:				
Hired labor	1,554	20.30	43.55	2.33
Unpaid labor**	273	3.69	7.89	.43
Fertilizer	196	2.65	5.67	.30
Feed, seed, & plants	121	1.69	3.60	.19
Machinery & building costs	474	5.44	11.65	.63
Land rent***	438	5.95	12.73	.69
Interest***	468	6.21	13.30	.72
All other expenses	525	7.98	17.08	.93
Total expenses	4,049	53.91	115.47	6.22
Income:				
Labor income	459	6.31	13.48	.74
Value of farm privileges	545	7.44	15.90	.86
Labor earnings	1,004	13.75	29.38	1.60
Value of operator's time	724	9.80	20.97	1.13
Return to capital	203	2.72	5.81	.33
Per cent return to capital	2	—	—	—
Capital investment, dollars	9,231	121	256	14
Acres in all crops	76	1	—	—
Acres in cane	36	—	—	—
Tons of cane sold	669	9	19	—

*Total receipts from cane sold, including government payments.

**Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

***Includes land rent at actual cost and interest on owned investment at 5 per cent of the value of the depreciated assets.

Farm Organization, 1946-1947

Tables 5 and 6 present average receipts, expenses, income, and related information for 503 family farms studied in 1946 and 500 studied in 1947. Most of the farms included in the 1946 study were included in the 1947 study, so that the data are directly comparable.

Farms surveyed in 1947 were about the same average size as those studied in 1946. Farms studied in 1946 had an average of 54 acres in all crops and 25 acres in sugar cane; those studied in 1947 had 54 acres in crops and 26 acres in cane (Table 5). Yields and per cent cropland in cane were about the same in both years.

TABLE 5. **Average Size and Yield and Other Related Information for Family-Type Sugar Cane Farms in Louisiana, 1946-1947**

	1946	1947
Number of Farms	503	500
	Per Farm	Per Farm
Average farm capital	7,460	6,927
Acres in crops	54	54
Acres in cane	25	26
Tons cane harvested	464	469
Tons cane sold	431	435
Tons harvested per acre	18.2	18.1
Tons sold per acre	17.2	16.8
Per cent cropland in cane	46	48
Per cent owning tractors	45	50
Per cent owning automobiles	56	60
Per cent owning trucks	20	20
Per cent white operators	72	71
Per cent Negro operators	28	29
Per cent owners	38	38
Per cent part owners	16	18
Per cent cash renters	16	18
Per cent share renters	30	26

The percentage of farms using tractors increased from 45 per cent to 50 per cent over the one-year period — a significant increase. There was little difference in the distribution of farms according to race and tenure for the two years.

Costs and Returns, 1946-1947

Although volume of business and yields per acre were about the same in 1946 and 1947, earnings were considerably higher in the latter year. This can be explained by the fact that from 1946 to 1947, prices received by sugar cane farmers increased to a greater extent than prices paid by farmers for materials of production. Over the one-year period, the price of cane increased 12 per cent, from $7.60 to $8.51 per ton, while total expenses increased only 7 per cent, from $7.92 to $8.38 per ton (Table 6).

In 1946, farmers realized $399 per farm, or $.93 per ton of cane, as the return for labor and management; in 1947, labor income was $722 per farm, or $1.66 per ton of cane sold. Labor earnings, which is the combined cash and non-cash return to labor, amounted to $936 per farm in 1946 and $1,415 in 1947.

The net cost of producing sugar cane in 1946 was $6.67 per ton as compared with $6.85 per ton in 1947.

MAJOR AND MINOR FACTORS AFFECTING PROFITS ON FAMILY-TYPE SUGAR CANE FARMS

Four elements are needed for the production of agricultural products: (1) land, upon which to grow the crop or keep the animal; (2) labor, to perform the essential operations; (3) capital, to purchase the needed materials and service; and (4) management, to organize and supervise farm operations. The success of any type of production depends upon the efficiency with which these four factors are organized and utilized.

TABLE 6. Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1946 and 1947

Costs and Returns	1946			1947		
	Average per Farm	Average per Acre Cane	Average per Ton Cane Sold	Average per Farm	Average per Acre Cane	Average per Ton Cane Sold
			Dollars			
Receipts:						
Sugar cane	3,273	129	7.60	3,709	143	8.51
Other	540	21	1.25	663	25	1.53
Total	3,813	150	8.85	4,372	168	10.04
Expenses:						
Fertilizer	193	7	.45	226	9	.52
Feed and seed	148	6	.34	170	6	.39
Repairs	78	3	.18	80	3	.18
Hired labor	1,067	42	2.48	1,027	40	2.36
Family labor	224	9	.52	339	13	.78
Land rent	452	18	1.05	498	19	1.14
Power equipment	302	12	.70	300	12	.69
Depreciation	307	12	.71	370	14	.85
Interest	373	15	.86	406	15	.93
Other costs	270	11	.63	234	9	.54
Total	3,414	135	7.92	3,650	140	8.38
Labor income	399	15	.93	722	28	1.66
Farm privileges	537	21	1.24	693	27	1.59
Labor earnings	936	36	2.17	1,415	55	3.25
Operator's labor	770	30	1.79	737	28	1.69
Return to capital	2	.00	—	391	15	.90
Total expenses (incl. interest)	3,414	135	7.92	3,650	140	8.38
Misc. income	540	21	1.25	663	25	1.53
Net costs	2,874	114	6.67	2,987	115	6.85
Sugar cane receipts	3,273	129	7.60	3,709	143	8.51
Net return from cane to pay operator for labor & management	399	15	.93	722	28	1.66

Studies of sugar cane farms over the ten-year period, 1938-1947, have attempted to determine the organization of those basic elements that leads to greatest success. The studies show that successful farms have different characteristics from those observed on unsuccessful farms. Those characteristics are referred to as "factors affecting profits" and are discussed in sections following.

Some of the factors affecting profits are economic and some are physical. The physical factors include: (1) variety selection; (2) methods of planting, fertilizing, cultivating, and harvesting; (3) fertilizer selection; and (4) disease and insect control. The physical factors are studied by the agronomist, the horticulturist, the animal husbandryman, etc., and will not be discussed in this report. Only the economic factors causing one producer to have lower costs and higher returns than another in the same area and in the same year will be analyzed.

In addition to the economic and physical factors, there are numerous other factors that influence farm profits indirectly. In this report the economic factors closely related to farm profits are referred to as "major factors," and other factors are called "minor factors."

Major Factors Affecting Farm Profits

Analysis of the studies made over the ten-year period reveal that the major factors affecting farm profits in the sugar cane area are: (1) yield; (2) size of farm business; (3) the degree of specialization in sugar cane production; and (4) labor and equipment efficiency.

Yield: Yield is the most important factor affecting profits on family sugar cane farms. If yields are low, profits will not be at a maximum, regardless of the magnitude of the other factors. Yield is the multiplier that gives effect to size. It costs almost as much to produce an acre of cane that yields a small tonnage as it does to produce an acre that yields a large tonnage. Yet the receipts from the acre with the high rate of production will be considerably greater. That extra tonnage will make a significant difference in the earnings of the two acres of land.

The relationship of yields to farm profits for various years may be observed in Appendix Table 11. The relationship of size and yield to farm earnings independently of the influence of each other is presented in Table 7.

TABLE 7. Relation of Size and Yield to Organization and Earnings of 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Group — Size and Yield*	Farm Income	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Number Farms
		Dollars		Acres	Tons	No.
Small size:						
Low yield	163	17	436	5	10	89
Medium yield	373	274	689	6	18	37
High yield	372	110	730	6	24	33
Medium size:						
Low yield	219	—11	454	15	11	71
Medium yield	720	434	957	16	17	69
High yield	1,155	852	1,396	17	24	43
Large size:						
Low yield	667	109	673	58	11	39
Medium yield	1,189	517	1,158	58	17	59
High yield	2,175	1,348	2,055	53	22	63

***Small** — 9 or less acres in cane.
Medium — 10 to 24 acres in cane.
Large — 25 or more acres in cane.
Low yield — less than 16 tons harvested per acre.
Medium yield — 16 to 20.9 tons harvested per acre.
High yield — 21 or more tons harvested per acre.

Size: Quite obviously a large volume of farm business is essential for large profits. Regardless of how efficiently it is organized and operated, a very small sugar cane farm cannot return large profits. Wherever possible, the farmer should cultivate as many acres as is physically possible with available labor and equipment. Facts available lead to the conclusion that under Louisiana conditions, a size of farm of 100 acres in crops, of which 50 acres are sugar cane, is needed to maintain an efficient family-type sugar cane farm.[4]

If yields are not extremely low, farm earnings increase directly with size. As long as yields are large enough for returns per unit to exceed unit costs, then the larger the size of farm, the larger the profits. However, when yields are very low, as in 1940, and unit costs exceed unit returns, then the larger the size, the greater the losses (Appendix Table 10).

Diversity or Specialization of the Farm Business: In general, a specialized farm is one that relies on a single source of income; a diversified farm is one that relies on several sources of income. Few farms are completely specialized or perfectly diversified, so that making a distinction between diversity and specialization is a matter of degree. In this report, farms which obtain more than 80 per cent of total receipts from one source, the sugar cane enterprise, are considered specialized. By that criterion, most farms in the area must be considered specialized, as sugar cane receipts constitute an average of 86 per cent of total receipts for the area as a whole.

In most farming areas, diversification is recommended in order that the factors of production can be used more fully and that the risks of depending upon one source of income will be eliminated. However, the many studies conducted in the Louisiana sugar cane area show that specialization is more profitable for all except very small farms (less than 10 acres in cane). On medium and large sized farms, the greater the proportion of cropland in sugar cane, the greater the farm earnings. On small farms, livestock or other crops produced along with sugar cane and during the off season add to farm profits (Appendix Table 13).

In view of the high productivity of soils and favorable climatic conditions in the sugar cane area, it is surprising that one-crop farming is more profitable. This unusual phenomenon can be explained largely by two factors: (1) the lack of market outlets discourages the production of other crops; and (2) the lack of low-cost pasturage prevents extensive livestock production.

The relationship of specialization in cane production to farm profits is revealed in Table 8. The effect of size and yield was reduced so that the influence of specialization alone may be observed. Because degree of specialization was related very closely to size, it was particularly necessary to reduce the effect of size. Largeness is conducive to increased specialization in that it permits the utilization of the factors more fully and economically.

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[4] *Costs and Returns of Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945,* Louisiana Experiment Station Bulletin No. 420, June 1947.

TABLE 8. Relation of Specialization in Cane Production to Earnings for 503 Family Farms in the Louisiana Sugar Cane Area, 1946

Group — Size, Yield and Specialization*	Farm Income	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per Cent Cropland in Cane	Number of Farms
		Dollars		Acres	Tons	Per Cent	No.
Small, Low yield, diversified	188	34	485	7	11	26	129
Small, Low yield, specialized	305	183	499	11	11	55	26
Small, High yield, diversified	533	278	854	8	23	27	74
Small, High yield, specialized	652	429	879	10	20	53	13
Large, Low yield, diversified	423	—84	493	31	12	36	32
Large, Low yield, specialized	601	180	705	42	13	60	86
Large, High yield, diversified	1,098	202	948	31	22	34	30
Large, High yield, specialized	1,861	1,298	1,910	48	20	60	113

*Small — 14 or less acres in cane.
Large — 15 or more acres in cane.
Low yield — less than 18 tons harvested per acre.
High yield — 18 tons or more harvested per acre.
Diversified — less than 45 per cent of cropland in cane.
Specialized — 45 per cent or more of cropland in cane.

Labor and Equipment Efficiency: As shown earlier, labor is the most expensive item involved in the production of sugar cane. It logically follows that any improvement in practices or equipment that decreases the costs of performing farm operations will increase farm profits. Therefore, labor and equipment efficiency is related directly to farm earnings. In general, the greater the output per worker, the greater are farm returns.

It must be pointed out that every method of increasing the output per man working on the farm does not decrease costs and result in greater earnings. In some cases the costs of using certain types of equipment may exceed the costs of hand labor required to do the same job. For example, the efficiency of some small farms was increased by using tractors (Table 9). The man work units accomplished per man on small, low-yield farms increased from 155 to 367, but labor income decreased from $+9 to $—46 as efficiency increased. The per cent of farms using tractors in the same groups increased from 6 per cent to 48 per cent. Quite obviously increased efficiency was achieved by mechanization which was not practical on the smaller sized farms (6 to 9 acres in cane). On medium and large farms, however, mechanization increased efficiency and reduced costs.

TABLE 9. Relation of the Output per Worker to Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Group — Size, Yield and Labor Efficiency*	Farm Income	Labor Income	Labor Earnings	Man Work Units per Man	Acres in Cane	Cane Sold per Acre	Per Cent Using Tractors	Number of Farms
	Dollars			No.	Acres	Tons	%	No.
Small, low yield, low efficiency	114	9	413	155	6	12	6	84
Small, low yield, medium efficiency	345	196	605	235	8	11	10	48
Small, low yield, high efficiency	264	—46	614	367	9	10	48	23
Small, high yield, low efficiency	332	152	603	150	7	21	14	28
Small, high yield, medium efficiency	652	381	922	242	9	22	16	49
Small, high yield, high efficiency	666	322	913	365	10	20	30	10
Large low yield, low efficiency	—366	—723	—274	174	24	12	38	8
Large, low yield, medium efficiency	443	126	647	250	31	13	55	49
Large, low yield, high efficiency	756	203	768	377	47	12	87	61
Large, high yield low efficiency	—143	—777	—174	169	29	20	100	7
Large, high yield, medium efficiency	1278	687	1271	262	35	21	66	56
Large, high yield, high efficiency	2159	1496	2178	394	52	20	79	80

***Small** — 14 or less acres in cane.
Large — 15 or more acres in cane.
Low yield — less than 18 tons harvested per acre.
High yield — 18 or more tons harvested per acre.
Low Efficiency — 199 or less man work units per man.
Medium efficiency — 200 to 299 man work units per man.
High efficiency — 300 or more man work units per man.

Minor Factors in the Organization and Operation of Family-Type Farms

The minor factors involved in the organization and operation of family farms analyzed in this section are: (1) age of the farm operator, (2) education of the farm operator, (3) race, (4) tenure, (5) size of the farm family, and (6) degree of farm mechanization. Although some of the factors listed are more sociologic than economic in character, their influence on the major economic factors and on general farm organization is important enough to demand study. Knowledge of the role played by these minor factors in the overall structure will materially aid programs designed to improve general farm organization and operation.

To determine the relationship of the minor factors to farm earnings, the influence of the factors having a major influence on farm earnings had to be reduced. Because of the expense involved, it was impractical to attempt to eliminate the influence of all factors except the ones studied. It was practical, however, to control the more important factors and approximate the effect of the other factors. As specialization and efficiency are related very closely to size, it was necessary to control only size and yield to obtain the desired effect of reducing the influence of the major factors.

Along with the relationship of the minor factors to farm earnings, the interrelationship of the minor factors and major factors was analyzed. In most cases the minor factors had more direct bearing on major factors than on farm profits, thus suggesting that an indirect approach to farm organizational problems and farm earnings may be effective in some instances.

Age of Farm Operator: Other things being equal, such as size of farm and yield per acre, young farmers appear to have the advantage over the older aged groups in sugar cane farming. The data in Table 11 reveal that operators less than 40 years of age had higher earnings than those 60 or over. In the small-farm, low-yield group, for instance, labor earnings averaged $534 for operators less than 40 as compared with $282 for those 60 years or more. In the large-farm and high-yield groups labor earnings varied from $2,173 per farm for the farmers less than 40 to $1,819 for those 60 years old or older.

This variation in earnings between the two age groups can be attributed primarily to the fact that the younger operators are able to do more work themselves and thus hire fewer men. Too, they can supervise the work of hired hands more closely than older farmers. As evidenced by the greater percentage of young farmers owning tractors, the young operators probably adopt modern methods more rapidly than old operators (Tables 10 and 11).

TABLE 10. Relation of Age of Farm Operators to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Age of the Farm Operator					
	29 or less	30 to 39	40 to 49	50 to 59	60 to 69	70 or more
	Average per Farm					
Size — acres in cane	28	28	24	22	26	24
Yield — tons sold per acre	16	17	17	16	18	18
Specialization — per cent cropland in cane	55	48	46	42	50	44
Efficiency — man work units per man	301	305	265	246	254	239
Per cent using tractors	49	51	44	45	39	32
Average farm capital — dollars	3,840	6,740	7,000	8,380	9,660	7,720
Years of formal schooling completed	5.1	4.4	3.1	2.3	1.8	0.0
Number of farms	37	133	123	101	87	22

TABLE 11. Relation of Age of Farm Operators to Farm Earnings When the Influence of Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups*	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars		Acres	Tons	Per Cent	No.	No.
Small, low-yield farms, young operators	100	534	8	11	28	244	47
Small, low-yield farms, middle age operators	117	568	7	12	29	205	70
Small, low-yield farms, old operators	—100	282	7	11	29	182	38
Small, high-yield farms, young operators	563	1,111	9	22	33	232	21
Small, high-yield farms, middle age operators	259	843	9	20	30	231	46
Small, high-yield farms, old operators	121	626	8	23	30	209	20
Large, low-yield farms, young operators	96	620	41	13	54	334	46
Large, low-yield farms, middle age operators	222	812	34	14	45	295	51
Large, low-yield farms, old operators	—141	308	36	12	54	295	21
Large, high-yield farms, young operators	1,568	2,173	43	20	57	357	56
Large, high-yield farms, middle age operators	522	1,193	41	21	51	305	57
Large, high-yield farms, old operators	1,171	1,819	53	21	38	333	30

*Young operators — 39 years old or less.
Middle age operators — 40 to 59 years old.
Old operators — 60 years old or more.

Education of the Farm Operator: Only 6 per cent of all the operators included in the 1946 study completed as much as nine years of formal schooling. The 503 operators averaged completing slightly more than three years, with nearly one-half, 46 per cent, having had only two years or less of formal education.

Farm operators in the high-education groups had much larger farms, obtained higher yields, were more highly specialized, and had greater labor and equipment efficiency (Table 12). When these major factors were not controlled, the high education groups had much larger earnings. But when the earnings of the educated and uneducated operators on farms of the same approximate size and productivity were compared, earnings were about equal (Table 13). The education level was so closely related to variations in the major factors, however, that no distinct conclusions could be drawn with respect to the importance of education to farm success until more intensive study has been made. Apparently, education has an important, although indirect, effect on farm earnings and is a medium through which farm management problems can be approached and solved. It is improbable that advantage in the major factors can be attributed wholly to the education factor. Such advantage may be attributed largely to variations in the wealth of parents, which also affects the educational level of individual operators.

TABLE 12. Relation of Education of Farm Operators to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Years of Formal Schooling				
	2 or Less	3 to 4	5 to 6	7 to 8	9 or More
	Average per Farm				
Size - acres in cane	21	22	28	30	53
Yield — tons sold per acre	17	17	17	16	19
Specialization — per cent cropland in cane	46	46	49	48	50
Efficiency — man work units per man	260	266	286	266	349
Per cent using tractors	33	36	57	66	100
Average farm capital — dollars	5,840	5,840	8,080	5,880	20,000

Race: The only racial groups in the area are Caucasians and Negroes, commonly called whites and Negroes. Negro operators are concentrated in the Pointe Coupee - West Baton Rouge and the St. Mary - St. Martin areas. The areas in which they are located generally are characterized by small farms. The average Negro-operated farm had only 12 acres in sugar cane and obtained yields of 14 tons of cane per acre (Table 14). Farms operated by whites averaged 31 acres of cane and sold 18 tons of cane per acre. Only 20 per cent of the Negro operators, as compared with 46 per cent of the white operators, were full owners. Two-thirds of the Negro farms were rented. The average value of the white-operated farms was $9,480 and of the Negro-operated farms, $2,400.

TABLE 13. Relation of Education of Farm Operators to Farm Earnings When the Influence of the Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups*	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per Cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars	Dollars	Acres	Tons	Per cent	No.	No.
Small, low-yield farms, poorly educated operators	69	494	7	12	28	211	147
Small, low-yield farms, highly educated operators	99	366	6	12	19	234	8
Small, high-yield farms, poorly educated operators	322	882	9	21	31	227	81
Small, high-yield farms, highly educated operators	12	531	7	22	35	211	6
Large, low-yield farms, poorly educated operators	181	714	37	12	52	306	104
Large, low-yield farms, highly educated operators	—430	154	50	15	51	338	14
Large, high-yield farms, poorly educated operators	949	1,570	40	21	54	323	122
Large, high-yield farms, highly educated operators	1,759	2,508	68	20	53	384	21

*__Poorly educated operators__ — 7 or less years of schooling.
__Highly educated operators__ — 8 or more years of schooling.

When all factors were permitted to have their full influence, white operators had much larger earnings. If the influence of other factors was reduced, there was no relationship between farm earnings and race (Table 15). Variations in labor income and labor earnings accompanying racial differences are inconsistent and unpredictable when other factors such as size and yield are made equal.

The most important point to be observed from this analysis is the very close relationship between race and the major factors. There is a very great difference in the size and productivity of white- and Negro-operated farms. Programs designed to improve production organization and raise the general size and productivity of family sugar cane farms should place particular emphasis on farms operated by Negroes.

Tenure: Tenure refers to the conditions under which the land is held. The common forms of tenure are: (1) full ownership; (2) part ownership; (3) cash renting; and (4) share renting. Of the 503 farms included in this study, 195 were owner-operated, 80 were part-owner-operated, 80 were cash renter-operated, and 148 were share renter-operated. Farmers who own all of the land operated are called "owners." Those who own part of the land operated and rent additional land are called "part-owners." "Cash renters" are those who pay a definite amount of money per acre or who pay a lump sum for the entire farm. "Share renters" give a specified proportion of crops as payments for the use of the land. Of course, there are some "share-cash renters" who pay cash for land devoted to feed crops and give a share of cash crops to the landlord. Because the share of crops given the landlord generally comprises the bulk of land rent charges, farms operated under the share-cash leasing agreement are classified as share renter farms in this report. Share croppers are practically non-existent in the sugar cane area. The expenses of the few that were found were included as hired labor.

TABLE 14. Relation of Race to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Race	
	White	Negro
	Average per Farm	
Size — acres in cane	31	12
Yield — tons sold per acre	18	14
Specialization — per cent cropland in cane	49	40
Efficiency — man work units per man	296	209
Per cent using tractors	59	8
Average farm capital — dollars	9,480	2,400
Years of schooling completed by operator	3.5	2.0
Number per farm family	5	5
Per cent owners	46	20
Per cent part owners	17	14
Per cent cash renters	9	33
Per cent share renters	28	33
Number of farms	360	143

TABLE 15. Relation of Race to Farm Earnings When the Influence of Major Factors is Reduced, 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars	Dollars	Acres	Tons	Per cent	No.	No.
Small, low-yield farms, white operators	—37	462	8	11	28	242	77
Small, low-yield farms, Negro operators	153	513	7	11	30	181	78
Small, high-yield farms, white operators	243	843	9	22	31	248	59
Small, high-yield farms, Negro operators	423	889	8	21	30	181	28
Large, low-yield farms, white operators	70	640	42	13	52	317	94
Large, low-yield farms, Negro operators	258	675	25	11	53	285	24
Large, high-yield farms, white operators	1,135	1,799	46	21	54	335	130
Large, high-yield farms, Negro operators	400	793	27	19	51	297	13

Cash and share renters furnish all labor, materials, equipment, and power and make minor repairs to buildings, fences, and roads. The landlord furnishes land and buildings and pays for major repairs, improvements, and taxes. Under the share rent agreement, the landlord sometimes pays part of the fertilizer, feed, and seed expenses, but usually these expenses are borne entirely by the share renter. Generally, the share renter gives only a portion of the cane crop in payment for the use of the farm but in some cases, the landlord takes a portion of feed and other cash crops, too. The most typical arrangement is for the share renter to give one-fourth of the cane crop. However, some pay one-third, others one-fifth, and still others one-sixth.

Share renters had the largest farms (Table 16). Share renter farms averaged 34 acres in cane, as compared with an average of 31, 23, and 11 acres in cane on part owner, owner, and cash renter farms, respectively. On the other hand, cash renters were at the greatest disadvantage when the major factors were concerned. Several explanations for this great disparity in the organization and management of share and cash renter farms may be advanced, of which the following is prevalent: Present owners of land in the sugar cane area are reluctant to sell or rent on a cash basis land that is so highly productive that it returns a good income when prices are high if rented on a share basis. When the general price level declines, the returns from share renting will decline, also, and possibly more land will be rented on a cash basis.

TABLE 16. Relation of Tenure to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Tenure			
	Owners	Part Owners	Cash Renters	Share Renters
	Average per Farm			
Size — acres in cane	23	31	11	34
Yield — tons sold per acre	17	18	15	16
Specialization — per cent cropland in cane	45	48	35	54
Efficiency — man work units per man	281	284	198	291
Per cent using tractors	48	64	14	48
Average farm capital	12,800	8,940	1,340	2,980
Number of farms	195	80	80	148

To determine the influence of tenure on farm earnings, the farms were separated into two groups — owners and renters. When the effect of the major factors was reduced, the data indicated that renters generally had larger returns to labor and management than owners (Table 17). This results from the fact that interest and depreciation expenses chargeable to owner farms exceeded rental charges borne by renters. On family sugar cane farms in 1946, of course, the financial advantages gained by tenurial status will change from year to year as the relationship between

TABLE 17. Relation of Tenure to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups	Farm Income	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars	Dollars	Dollars	Acres	Tons	Per cent	No.	No.
Small, low-yield, owner farms	152	—121	392	8	11	30	242	71
Small, low-yield, renter farms	255	210	568	7	11	29	186	84
Small, high-yield, owner farms	537	166	813	9	21	30	227	52
Small, high-yield, renter farms	571	500	924	9	21	33	226	35
Large, low-yield, owner farms	682	4	559	35	13	48	315	64
Large, low-yield, renter farms	399	232	752	43	12	57	304	54
Large, high-yield, owner farms	1,775	882	1,579	41	21	51	323	88
Large, high-yield, renter farms	1,583	1,365	1,914	50	20	59	345	55

overhead and rent charges changes. Theoretically, renters should be at the greatest advantage financially during periods of low prices because rent tends to vary with the general price level and overhead charges remain relatively stable. Before developing long-time conclusions, additional studies of actual changes under various prices conditions must be made.

The fact that this study shows renters to have a financial advantage over owners does not suggest that all family sugar cane farmers should be renters. There are many advantages concomitant to private ownership which cannot be measured in dollars and cents. However, it does suggest that many owners of small farms can increase their earnings by renting additional land needed to make their farming unit more efficient, but which they are unable to buy. It indicates that it is more desirable to rent a large farm and invest available cash in equipment than to buy a small unit that is not large enough to permit efficient organization and operation.

Size of the Farm Family: By "size of the farm family" is meant the number of persons living on the farm who are dependent upon the farm for subsistence. This factor affects farm earnings by increasing or decreasing the family labor supply and, consequently, by increasing or reducing farm labor costs. Whether size of family has any bearing depends largely upon the age and sex of children. It is believed that in most instances family labor varies directly with the size of the family and to make allowances for age and sex will only complicate the analysis. Consequently, no such modifications were made.

The average farm family in the area had five members and was composed of a husband, wife, and three children. Only one major factor, size of farm, tended to vary with the size of the family unit (Table 18). The smallest families had the smallest farms and the largest families had the largest farms. Farms with medium-sized families were of the same approximate size.

TABLE 18. Relation of Size of the Farm Family to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Number per Farm Family				
	2 or Less	3 to 4	5 to 6	7 to 8	9 or More
	Average per Farm				
Size — acres in cane	14	26	26	27	33
Yield — tons sold per acre	14	17	18	17	17
Specialization — per cent cropland in cane	41	48	49	47	47
Efficiency — man work units per man	219	284	284	267	270
Per cent using tractors	18	48	47	40	67
Average farm capital	2,380	8,795	7,485	6,679	7,174
Number of farms	65	165	132	78	63

TABLE 19. Relation of Size of the Farm Family to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups*	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars	Dollars	Acres	Tons	Per cent	No.	No.
Small, low-yield farms, small families	—2	372	7	11	28	213	85
Small, low-yield farms, large families	132	627	8	11	31	209	70
Small, high-yield farms, small families	153	631	8	21	31	225	41
Small, high-yield farms, large families	432	598	9	22	29	227	46
Large, low-yield farms, small families	—167	317	38	13	53	306	51
Large, low-yield farms, large families	317	898	39	12	51	314	67
Large, high-yield farms, small families	1,171	1,735	42	21	52	343	53
Large, high-yield farms, large families	1,007	1,692	46	20	55	325	90

***Small family** — 4 members or less.
Large family — 5 members or more.

Generally, farms with large families tended to have slightly larger earnings than those with small families. The relationship between size of the farm family and farm income was neither consistent nor distinct, however, and no unqualified conclusion can be gained from the data (Table 19). Some advantage can be gained by fitting the size of the farm unit to the available labor supply; however, the data do not indicate that this practice has been followed in the Louisiana sugar cane area. In fixing the size of a unit to utilize family labor fully and efficiently, many things would have to be considered, of which the most important is the type of power and equipment to be employed.

Degree of Mechanization: In this study the degree of farm mechanization refers to the number of tractors owned per farm. Of the 503 farms included in this study, 304 had no tractors, 178 had one, and 21 had two or more.

Throughout the study a very close relationship between size of the farm business and degree of mechanization was observed. Table 20 reveals that farms with no tractors had an average of 13 acres in cane, those with one tractor had 38 acres, and those with two tractors or more had 99 acres in cane. This close correlation indicates that degree of mechanization may be a good measure of size of farm business in the sugar cane area.

The devices employed to control the influence of size were not adequate when applied to large mechanized and non-mechanized groups. Therefore, the data for those two groups were not comparable and no conclusion could be drawn.

In the small-size groups, the effect of size was reduced enough so that an analysis could be made. Comparison of cost and income data for small mechanized and small non-mechanized groups revealed an inverse relationship between farm mechanization and earnings (Table 21). The relatively large number of small farms (less than 15 acres in cane) using tractors was very surprising. Even more surprising was the fact that these same farms kept the same number of mules after buying a tractor.

TABLE 20. Relation of Degree of Mechanization to Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Management Factors	Number of Tractors		
	None	One	Two or More
	Average per Farm		
Size — acres in cane	13	38	99
Yield — tons sold per acre	17	17	17
Specialization — per cent cropland in cane	39	52	52
Efficiency — man work units per man	236	325	338
Average farm capital	3,740	10,540	35,480
Number of farms	304	178	21

TABLE 21. Relation of Degree of Farm Mechanization to Farm Earnings for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Groups*	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Cropland in Cane	Man Work Units per Man	Number of Farms
	Dollars	Dollars	Acres	Tons	Per cent	No.	No.
Small, low-yield, non-mechanized	172	586	7	11	30	199	134
Small, low-yield, mechanized	—669	—145	10	9	24	293	21
Small, high-yield, non-mechanized	472	1,008	8	23	31	221	72
Small, high-yield, mechanized	—519	136	10	21	25	253	15
Large, low-yield, non-mechanized	411	865	23	12	53	290	48
Large, low-yield, mechanized	—199	498	50	12	52	324	70
Large, high-yield, non-mechanized	942	1,692	27	21	47	304	50
Large, high-yield, mechanized	1,071	1,770	54	20	57	346	93

*__Non-mechanized__ — no tractors.
Mechanized — one tractor or more.

Obviously if they had enough power with three mules before buying the tractor, they did not need three after buying it. The data clearly indicate that unless a large amount of custom work is done, small sugar cane farms should hire tractor work or buy tractors cooperatively.

The fixed costs (interest and depreciation) involved in owning and operating a tractor are very high. Only by producing a large volume and using the tractors a great number of days can unit costs be reduced to such an extent that a tractor can be employed to advantage. Small farms do not permit this extensive usage. Therefore, on small farms tractor costs exceed hired labor costs and tend to affect profits adversely.

Just what a size a farm must be before it is profitable to introduce various types of mechanical power and equipment cannot be determined from this study. However, there can be no set rules that will fit all cases. The introduction of power equipment to the farming system must be governed by many considerations, and the size of the unit will vary with individual conditions. Certainly mechanical power can be used to advantage on large farms, but it appears to be an expensive luxury on small farms that do no custom work.

SUMMARY

1. Detailed farm management and cost studies of the operation of family-type sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station for most years since 1938. This report summarizes the detailed results of this series of studies for 1946 and 1947 with comparisons with the earlier period.
2. Records were collected from 503 family-type sugar cane farms in 1946 and 500 in 1947. The sample studied represented between 5 and 10 per cent of all family-type sugar cane farmers in Louisiana in the recent 1946-47 period and is similar in size and composition to the sample of farms surveyed in the long-time 1938-45 period.
3. The average size of the family-type sugar cane farms studied for the 1946-47 period was about 75 acres, including 54 acres in cropland of which 26 acres were planted to sugar cane. About 37 per cent of these farms were operated by producers who owned their farms; 19 per cent were operated by growers who owned part of their land and rented part; 18 per cent were operated by cash renters; and 26 per cent by share renters.
4. The most significant changes in the organization of family-type sugar cane farms in Louisiana in recent years have been the shift towards smaller operating units maintained primarily with family labor and the change from mule to tractor farming. The average planted acreage of sugar cane per farm declined from 41 acres in 1946 to 26 acres in 1947. The number of farms having tractor power increased from 17 per cent to 50 per cent during the same period. Both of these changes were caused primarily by increasing hired labor costs during the period.

5. The average labor income, or cash profit from sugar cane production to pay the operator for his labor, varied from about $400 per farm in 1946 to $722 in 1947. Returns were higher in 1947 than in 1946 because of increased prices received for sugar cane; total income from sugar cane averaged $8.51 per ton in 1947, which was the highest point in the recent history of the sugar cane industry. Prices in 1948, however, declined to about $7.20 per ton.
6. For the 10-year period, 1938 to 1947, these family-type sugar cane farmers produced sugar cane at an average cost of $115 per acre, or $6.22 per ton of cane sold, not including the value of the unpaid labor of the farm operator as a cost. Gross income for the period amounted to $129 per acre, or $6.96 per ton. The average labor income per year, or the amount of cash remaining to pay the operator for his year's work on the farm, averaged $459 per farm, $13 per acre of cane produced, or $0.74 per ton of cane sold.
7. The financial results of this series of studies of family-type sugar cane farms show that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. The major economic factors influencing net returns were found to be the size of the farm, the yield of cane per acre, the proportion of the cropland planted to cane, and the relative efficiency in the use of man labor and equipment.
8. The more efficient producers in the area were those who maintained a size of farm of about 100 acres in crops with 50 acres in sugar cane, those who obtained average yields over a long-time period of 20 tons per acre or more, the large producers who specialized in sugar cane production and the small farm producers who maintained a diversified farming program, and those who maintained labor efficiency to the extent of accomplishing 300 days of productive work per man for the year.
9. In addition to the major factors affecting returns, certain minor factors were also important. The age of the farm operator was found to be important, with the younger farmers obtaining greater labor efficiency and obtaining higher returns; the level of education was important in influencing major factors determining profits; the tenant farmers with fairly large farms made greater earnings than the smaller owner-operated farms; and although mechanization paid on the larger farms, many of the smaller farms made low returns when shifting to tractor power without a sufficient volume of business to justify the change. There was little or no relationship between the race or color of the farm operator or the size of the farm family to returns from sugar cane farming.

APPENDIX TABLES

APPENDIX TABLE 1. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs and Returns per Farm	1938	1940	1942	1943	1944	1945	1946	1947
				Dollars				
Direct farm expenses	2,876	2,173	2,576	3,950	4,212	3,786	2,589	2,746
Rent and interest	693	613	718	1,068	1,254	1,153	825	904
Total farm expenses	3,569	2,786	3,294	5,018	5,466	4,939	3,414	3,650
Receipts from sources other than sugar cane	413	494	642	525	913	981	540	663
Net cost of producing sugar cane	3,156	2,292	2,652	4,493	4,553	3,958	2,874	2,987
Total returns from cane sold	3,075	1,689	3,169	5,407	5,524	4,840	3,273	3,709
Profit from sugar cane to pay operator for his labor	—81	—603	517	914	971	882	399	722
Value of farm privileges	321	343	510	530	763	696	537	693
Total cash and non-cash profits from sugar cane	240	—260	1,027	1,444	1,734	1,578	936	1,415
Cash return per month	—7	—50	43	76	81	74	33	60
Non-cash return per month	27	29	43	44	64	58	45	58
Total return per month to pay operator for his labor	20	—21	86	120	145	132	78	118

APPENDIX TABLE 2. Costs and Returns per Acre of Cane Grown on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs and Returns per Acre	1938	1940	1942	1943	1944	1945	1946	1947
				Dollars				
Direct farm expenses	70.15	62.09	73.60	89.77	100.29	118.31	102.00	106.00
Rent and interest	16.90	17.51	20.51	24.27	29.86	36.03	33.00	34.00
Total farm expenses	87.05	79.60	94.11	114.04	130.15	154.34	135.00	140.00
Receipts from sources other than sugar cane	10.07	14.11	18.34	11.93	21.74	30.66	21.00	25.00
Net cost of producing sugar cane	76.98	65.49	75.77	102.11	108.41	123.68	114.00	115.00
Total returns from cane sold	75.00	48.26	90.54	122.89	131.52	151.25	129.00	143.00
Profits from sugar cane to pay operator for his labor	—1.98	—17.23	14.77	20.78	23.11	27.57	15.00	28.00
Value of farm privileges	7.83	9.80	14.57	12.05	18.16	21.75	21.00	27.00
Total cash and non-cash profits from sugar cane	5.85	—7.43	29.34	32.83	41.27	49.32	36.00	55.00
Value of operator labor	10.49	15.71	18.68	15.25	26.31	27.91	30.00	28.00
Net gain over value of operator labor	—4.64	—23.14	10.66	17.58	14.96	21.41	6.00	27.00
Acres of cane per farm	41	35	35	44	42	32	25	26

APPENDIX TABLE 3. Average Labor Returns to the Operator from the Sugar Cane Enterprise for Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs and Returns	1938	1940	1942	1943	1944	1945	1946	1947
Costs and returns per farm:				Dollars				
Income from sugar cane	3,075	1,689	3,169	5,407	5,524	4,840	3,273	3,709
Net costs	3,156	2,292	2,652	4,493	4,553	3,958	2,874	2,987
Cash profit to pay farmer for his labor	—81	—603	517	914	971	882	399	722
Value of farm privileges	321	343	510	530	763	696	537	693
Total profit to pay farmer for his labor	240	—260	1,027	1,444	1,734	1,578	936	1,415
Costs and returns per hour:								
Cash return per hour of labor*	—.03	—.24	.20	.36	.38	.35	.16	.28
Non-cash return per hour of labor*	.12	.14	.20	.21	.30	.27	.21	.27
Total return per hour of labor*	.09	.10	.40	.56	.68	.62	.37	.55
Farmer's estimate of value per hour of his labor	.17	.22	.26	.26	.43	.35	.30	.29
Minimum wage rate in the area**	.15	.15	.18	.23	.25	.27	.40	.40

*Based on an average of 10.1 months of 25 working days of full-time work on the farm as reported by the farmers surveyed, or a total of 2,550 hours of work for the year.

**Average of hourly rate as established by the U. S. Department of Agriculture, for each year for common male labor, with harvesting rates weighted at 30 per cent and cultivating rates at 70 per cent.

APPENDIX TABLE 4. Tenure of Farm Operators Surveyed, Family-Type Louisiana Sugar Cane Farms, 1938-1947

	1938	1940	1942	1943	1944	1945	1946	1947
Farms in each tenure group:				Number				
Full owners	165	128	115	29	39	222	195	189
Part owners and renters	156	155	123	43	29	66	80	93
Cash renters	80	69	110	12	25	106	80	90
Share renters	99	101	119	26	17	113	148	128
Total	500	453	467	110	110	507	503	500
Proportion in each group:				Per cent				
Full owners	33	28	25	26	35	44	38	38
Part owners and renters	31	34	26	39	26	13	16	18
Cash renters	16	15	24	11	23	21	16	18
Share renters	20	23	25	24	16	22	30	26
Total	100	100	100	100	100	100	100	100

APPENDIX TABLE 5. Livestock and Equipment on Family-Type Louisiana Sugar Cane Farms, 1942 and 1946

Item	1942			1946		
	Proportion of all Farms Having the Item	Number per Farm Reporting the Item	Average Value per Item	Proportion of all Farms Having the Item	Number per Farm Reporting the Item	Average Value per Item
	Per cent	Number	Dollars	Per cent	Number	Dollars
Livestock:						
Workstock	100	4	173	100	3	169
Milk cows	72	4	61	83	2	167
Other cattle	38	6	44	40	8	36
All hogs	86	7	113	74	5	183
Chickens	92	82	1	97	66	1
Power Equipment:						
Tractors	26	1	1,298	45	1	1,474
Trucks	30	1	558	20	1	711
Automobiles	60	1	446	56	1	333
Other Equipment:						
Diggers, cane	16	1	45	19	1	41
Disc harrow	44	1	52	30	1	87
Feed grinders	20	1	25	6	1	98
Fertilizer distributors	26	1	27	33	1	35
Hand hoes	100	6	1	100	3	1
Hoist and derrick	16	1	423	6	1	389
Knives, cane	100	11	1	36	7	1
Listers	38	1	56	20	1	50
Middle busters	52	1	15	57	1	17
Mowers	57	1	58	32	1	64
Planters	77	1	20	66	1	19
Plows, double	48	1	16	24	1	19
Plows, single	100	3	14	98	2	15
Riding cultivators	64	1	68	60	1	62
Saddles	38	1	17	18	1	20
Shavers, cane	51	1	28	26	1	72
Spike harrows	100	2	8	79	2	8
Trailers	—	—	—	17	1	358
Wagons	100	2	115	93	1	136
Walking cultivators	82	1	31	46	1	29
Work gears	100	4	9	98	3	12

APPENDIX TABLE 6. Distribution of Capital Investment on Family-Type Sugar Cane Farms in Louisiana, 1942, 1945, 1946 and 1947

Capital Items	Average Investment per Farm					
	Owners		Renters		All Farms	
	1942	1945	1942	1945	1946	1947
	Dollars					
Land	5,643	9,299	——	——	2,981	2,439
Buildings	3,428	4,333	——	——	1,725	2,052
Total real estate	9,071	13,632	——	——	4,706	4,491
Workstock	747	822	520	644	——	——
Cattle	318	350	155	187	——	——
Other livestock	214	232	105	134	——	——
Total livestock	1,279	1,404	780	965	915	741
Tractors	537	860	14	488	662	751
Trucks	231	213	5	110	143	118
Farm automobiles	372	250	169	130	187	147
Other equipment	862	1,115	271	770	780	679
Total machinery and equipment	2,002	2,438	459	1,498	1,772	1,695
Total investment	12,352	17,474	1,239	2,463	7,393	6,927

APPENDIX TABLE 7. Cost of Tractor Work on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs	1938	1940	1942	1945	1946	1947
	Dollars					
Cost per day of use (9 hours):						
Fuel oil and gasoline	1.82	1.82	1.85	1.57	1.99	1.75
Lubricating oil and grease	.50	.28	.30	.38	.34	.27
Repairs	.19	.52	.50	.85	1.51	.85
Other cash costs	.37	.09	.17	.28	.44	.28
Total operating expenses	2.88	2.71	2.82	3.08	4.28	3.15
Depreciation	1.98	1.76	.74	1.37	3.52	2.81
Interest	.66	.45	.44	.47	.88	.70
Total overhead expenses	2.64	2.21	1.18	1.84	4.40	3.51
TOTAL COSTS	5.52	4.92	4.00	4.92	8.68	6.66
Operating costs per hour	.32	.30	.31	.34	.48	.35
Overhead costs per hour	.29	.25	.14	.21	.49	.38
Total costs per hour	.61	.55	.45	.55	.97	.73
Number of tractors studied	85	101	123	176	226	250
9-hour days of use per tractor	81.9	103.4	148.8	179.4	87.0	107.0
Average value per tractor (dollars)	1,079	939	1,298	1,664	1,474	1,503

APPENDIX TABLE 8. Costs of Operating Farm Trucks on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs	1938	1940	1942	1945	1946	1947
			~~Dollars~~		Cents	
Costs per mile of use:						
Gasoline	1.90	1.68	1.96	1.90	1.46	2.39
Oil	.25	.22	.26	.31	.17	.30
Repairs	.58	.63	.74	2.30	2.12	1.80
Tires	.47	.22	.46	1.58	1.41	.87
Insurance	.18	.30	.26	.22	.20	.12
License	.45	.37	.16	.15	.10	.12
Total operating costs	3.83	3.42	3.84	6.46	5.46	5.60
Depreciation	1.59	2.80	1.49	1.44	2.91	2.09
Interest	.32	.70	.46	.56	.73	.52
Total overhead costs	1.91	3.50	1.95	2.00	3.64	2.61
TOTAL COSTS	5.74	6.92	5.79	8.46	9.10	8.21
Number of trucks studied	78	129	142	121	101	99
Miles of use per year	5,578	4,126	6,056	6,085	4,885	5,712
Average value per truck (dollars)	361	580	558	679	711	596

APPENDIX TABLE 9. Costs of Operating Farm Automobiles on Family-Type Sugar Cane Farms in Louisiana, 1938-1947

Costs	1938	1940	1942	1945	1946	1947
			~~Dollars~~		Cents	
Costs per mile of use:						
Gasoline	1.19	1.19	1.18	1.35	1.31	1.67
Oil	.16	.15	.12	.31	.17	.25
Repairs	.25	.35	.74	1.46	2.08	1.58
Tires	.24	.25	.15	.80	.67	.49
Insurance	.06	.10	.07	.05	.05	.04
License	.16	.19	.06	.06	.06	.05
Total operating costs	2.06	2.23	2.32	4.03	4.34	4.08
Depreciation	.68	1.49	1.44	.94	1.36	.84
Interest	.25	.33	.42	.50	.34	.21
Total overhead costs	.93	1.82	1.86	1.44	1.70	1.05
TOTAL COSTS	2.99	4.05	4.18	5.47	6.04	5.13
Number of automobiles studied	281	270	279	255	282	298
Miles of use per year	7,720	6,332	5,330	5,509	4,917	5,870
Average value per car (dollars)	380	420	446	548	333	247
Per cent of use for farm	55	48	83	62	64	51

APPENDIX TABLE 10. Relation of Size of Farm to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana

Costs and Returns per Farm	1940			1942			1944			1946		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
						Dollars						
Farm Receipts:												
Sugar cane	502	1,402	4,484	868	2,770	8,582	1,344	4,720	13,823	628	1,947	7,831
All other income	294	389	1,231	483	486	1,163	973	552	1,166	616	423	634
Total	796	1,791	5,715	1,351	3,256	9,745	2,317	5,272	14,989	1,244	2,370	8,465
Farm Expenses:												
Hired labor	231	694	3,057	243	837	3,155	592	2,110	4,949	144	493	2,786
All other costs	517	1,004	2,827	662	1,287	3,060	1,042	1,975	5,637	725	1,047	3,014
Total	748	1,698	5,884	905	2,124	6,215	1,634	4,085	10,586	869	1,540	5,800
Rent costs	93	183	435	114	278	903	77	142	314	120	200	1,131
Farm income	—45	—90	—604	332	854	2,627	606	1,045	4,089	255	630	1,534
Interest	166	342	1,050	168	349	882	261	605	1,465	199	268	747
Labor income	—211	—432	—1,654	164	505	1,745	345	440	2,624	56	362	787
Farm privileges	273	374	465	419	577	626	600	791	1,029	460	505	687
Labor earnings	62	—58	—1,189	583	1,082	2,371	945	1,231	3,653	516	867	1,474
Acres of cane per farm	11	28	96	10	28	89	10	33	108	6	16	59
Yield per acre of cane, tons	14	15	14	17	18	18	22	23	21	15	17	18
Tons of cane sold per farm	152	430	1,380	160	506	1,584	217	760	2,227	83	256	1,031
Number of farms	234	113	106	237	111	113	52	29	29	159	183	161

APPENDIX TABLE 11. Relation of Yield per Acre of Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana

Costs and Returns per Farm	1940			1942			1944			1946		
	Low Yield	Medium Yield	High Yield	Low Yield	Medium Yield	High Yield	Low Yield	Medium Yield	High Yield	Low Yield	Medium Yield	High Yield
						Dollars						
Farm Receipts:												
Sugar cane	1,033	2,113	2,067	1,519	2,916	5,099	4,862	5,730	6,147	1,562	3,874	5,288
All other income	396	597	691	390	543	987	970	701	1,097	623	427	588
Total	1,429	2,710	2,758	1,909	3,459	6,086	5,832	6,431	7,244	2,185	4,301	5,876
Farm Expenses:												
Hired labor	718	1,340	1,106	472	1,078	1,713	2,096	2,204	2,487	496	1,264	1,733
Other direct costs	1,049	1,367	1,223	976	1,212	1,993	2,722	1,941	2,524	1,155	1,637	2,027
Total	1,767	2,707	2,329	1,448	2,290	3,706	4,818	4,145	5,011	1,651	2,901	3,760
Rent costs	152	239	215	206	298	529	100	125	271	247	538	684
Farm income	—490	—236	214	255	871	1,851	914	2,161	1,962	287	862	1,432
Interest	357	485	436	225	348	573	721	565	327	257	407	531
Labor income	—847	—721	—222	30	523	1,278	193	1,596	1,635	30	455	901
Farm privileges	333	357	346	494	487	543	734	716	959	464	576	636
Labor earnings	—514	—364	124	524	1,010	1,821	927	2,312	2,594	494	1,031	1,537
Acres of cane per farm	34	42	30	25	33	44	48	41	35	19	31	31
Yield per acre of cane, tons	10	15	20	12	17	21	16	22	29	11	18	24
Tons of cane sold per farm	337	639	617	280	536	940	782	924	992	206	510	696
Number of farms	184	116	153	139	160	168	41	38	31	199	165	139

APPENDIX TABLE 12. Relation of Output per Worker to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana*

Costs and Returns per Farm	1942			1944			1946		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
					Dollars				
Farm Receipts:									
Sugar cane	1,392	3,467	5,977	1,656	3,750	11,061	1,043	2,730	5,135
Other income	801	565	547	992	1,125	623	441	465	673
Total	2,193	4,032	6,524	2,648	4,875	11,684	1,484	3,195	5,808
Farm Expenses:									
Hired labor	557	1,305	1,786	694	2,074	3,921	234	942	1,685
Other direct costs	1,112	1,330	2,010	1,475	1,558	4,132	944	1,348	2,036
Total	1,669	2,635	3,796	2,169	3,632	8,053	1,178	2,290	3,721
Rent costs	141	371	662	100	120	249	150	272	811
Farm income	383	1,026	2,066	379	1,123	3,382	156	633	1,276
Interest	264	403	576	295	520	1,181	165	348	523
Labor income	119	623	1,490	84	603	2,201	—9	285	753
Farm privileges	473	521	552	678	676	934	427	532	456
Labor earnings	592	1,144	2,042	762	1,279	3,135	418	817	1,209
Acres in cane per farm	14	35	66	11	26	88	9	21	40
Acres in cane per man	6	10	16	4	8	24	5	9	15
P. m. w. u. per man	—	—	—	—	—	—	157	239	372
Tons of cane per acre	18	18	17	23	22	21	17	19	18
Tons of cane sold per farm	260	632	1,101	267	606	1,782	138	359	676
Number of farms	192	150	125	36	37	37	116	192	195

*In 1942 and 1944, output per worker was measured by acres of cane per man and, in 1946, by productive man work units per man.

APPENDIX TABLE 13. Relation of Proportion of Cropland in Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana

Costs and Returns per Farm	Per cent Cropland in Cane, 1940			Per cent Cropland in Cane, 1942			Per cent Cropland in Cane, 1944			Per cent Cropland in Cane, 1946		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
					Dollars							
Farm Receipts:												
Sugar cane	773	1,029	2,671	851	1,358	4,986	1,582	4,632	10,746	894	2,642	5,411
All other income	692	348	552	1,150	588	514	1,547	502	596	1,059	534	199
Total	1,465	1,377	3,223	2,001	1,946	5,500	3,129	5,134	11,342	1,953	3,176	5,610
Farm Expenses:												
Hired labor	558	597	1,591	364	389	1,717	1,035	2,071	3,750	332	876	1,723
Other direct costs	895	855	1,562	1,016	932	1,781	1,376	1,917	3,981	1,184	1,406	1,849
Total	1,453	1,452	3,153	1,380	1,321	3,498	2,411	3,988	7,731	1,516	2,282	3,572
Rent costs	147	153	258	125	195	504	126	76	268	142	295	797
Farm income	—135	—228	—188	496	430	1,498	592	1,070	3,343	295	599	1,241
Interest	324	316	549	240	208	526	293	686	1,070	315	355	428
Labor income	—459	—544	—737	256	222	972	299	384	2,273	—20	244	813
Farm privileges	321	326	370	426	476	554	607	797	905	547	521	543
Labor earnings	—138	—218	—367	682	698	1,526	906	1,181	3,178	527	765	1,356
Acres of cane per farm	17	24	55	9	16	52	11	36	81	8	21	41
Per cent cropland in cane	17	24	55	21	35	55	24	45	62	22	40	61
Yield per acre of cane, tons	14	14	15	17	16	18	21	22	22	16	18	19
Tons of cane sold per farm	360	440	890	157	250	918	256	745	1,731	118	348	707
Number of farms	118	143	192	92	114	261	40	34	36	132	173	198

APPENDIX TABLE 14. Relation of the Combined Effect of Superiority in Size, Yield, Intensity of Cane Enterprise, and Labor Efficiency to Returns from Farming, Louisiana Family-Type Sugar Cane Farms, 1944 and 1946

	1944		1946	
	Number of Farms	Average Labor Income	Number of Farms	Average Labor Income
	Number	Dollars	Number	Dollars
Below average in all 4 factors	23	71	118	24
Above average in 1 of 4 factors	34	401	128	125
Above average in 2 of 4 factors	17	649	104	275
Above average in 3 of 4 factors	23	910	98	332
Above average in all 4 factors	13	4,642	56	2,146

APPENDIX TABLE 15. Relation of Race and Tenure to Farm Earnings and Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Race and Tenure	Labor Income	Labor Earnings	Acres in Cane	Cane Sold per Acre	Per cent Using Tractors	Number of Farms
	Dollars		Acres	Tons	Per cent	No.
Negro owners	52	573	10	15	11	28
Negro part owners	239	607	17	12	15	20
Negro cash renters	312	670	6	15	0	48
Negro share renters	297	661	16	15	13	47
White owners	290	924	25	17	54	167
White part owners	389	1,039	35	20	80	60
White cash renters	555	1,035	17	16	34	32
White share renters	754	1,283	43	16	64	101

APPENDIX TABLE 16. Relation of Parish of Residence to Farm Earnings and Various Management Factors for 503 Family Farms in the Sugar Cane Area of Louisiana, 1946

Item	Parish									
	Pointe Coupee	West Baton Rouge	Iberville	Terrebonne	Ascension	Lafourche	Assumption	St. Mary	Iberia	St. Martin
Number of farms	96	30	56	67	11	66	19	41	70	47
Labor income	189	99	1,122	17	305	314	458	456	553	657
Labor earnings	740	582	1,690	611	829	848	957	885	1,137	1,126
Acres in cane	10	11	58	20	16	20	30	32	32	27
Yield—tons sold per acre	18	14	18	14	19	19	16	15	19	15
Per cent using tractors	19	17	95	64	55	56	58	39	39	21
Average farm capital	3,040	940	13,700	7,480	7,360	5,540	6,020	5,420	9,640	3,060
Per cent white operators	52	37	91	100	82	98	89	39	73	49
Per cent Negro operators	48	63	9	—	18	2	11	61	27	51
Per cent owners	41	27	43	69	73	32	32	24	36	17
Per cent part owners	3	7	9	13	27	21	32	29	31	9
Per cent cash renters	45	47	9	12	—	3	16	7	3	—
Per cent share renters	11	19	39	6	—	44	20	40	30	74

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LOUISIANA COTTON STATISTICS WITH COMPARISONS

By

J. P. MONTGOMERY

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
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AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

CONTENTS

Page

Introduction 4

Cotton situation in recent years 5

World supply and United States farm price for cotton, 1920-1948, Figure 1 6

Commercial cotton, all growths: World supply and consumption, 1920-1948, Table 1 7

Cotton exports 8

Cotton: Production, supply, price, value and distribution, United States, 1790-1947, Table 2 9

Cotton production changes 13

Cotton lint: Acreage, yield, production, price, and farm value, United States, 1866-1947, Table 3 14

Cotton lint: Acreage, yield, production, price and farm value, Louisiana, 1866-1948, Table 4 16

Acreage of cotton in Louisiana and United States farm prices per pound for cotton lint, 1869-1948, Figure 2 18

Trends in cotton acreage, yield, and production by areas in the United States, Table 5 18

Cotton carry-over 19

Cotton prospects for the future 19

Prospective exports of cotton 20

Future cotton production 21

The farm labor supply 21

Mechanization and other technological developments 22

Alternatives to cotton production 25

Government programs 26

Distribution of cotton acreage among cotton production areas of the United States, 1937, 1942, and 1947, Table 6 27

Cash receipts from cotton lint and cottonseed, and comparisons, Louisiana, 1924-1948, Table 7 28

Percentages of total cash receipts from farm marketings received by Louisiana farmers from sales of cotton, cottonseed, other crops, and livestock and livestock products, 1924-1947, Figure 3 29

Type-of-farming areas map of Louisiana, Figure 4 30

Cotton lint: Acreage, yield, and production by parishes and by type-of-farming areas, Louisiana, 1928-1947, Table 8 31

Cotton: Estimated percentage of total lint sales by months, Louisiana, 1924-1948, Table 9 45

CONTENTS

Page

Cotton: Estimated percentage of total lint sales made by farmers by months, United States, 1924-1948, Table 10 46

Cotton lint: Average price received by farmers monthly, Louisiana, August 1909-December 1948, Table 11 47

Cotton lint: Average price received by farmers monthly, United States, August 1909-December 1948, Table 12 48

Cotton-middling: Average spot price per pound at New Orleans, September 1900-March 1948, Table 13 49

Cotton-middling: Average spot price per pound at 10 markets, August 1915-March 1948, Table 14 50

Cottonseed: Production, farm price, quantity crushed, and products obtained, United States, 1874-1947, Table 15 51

Cottonseed: Production, disposition, price, and farm value, Louisiana, 1909-1947, Table 16 53

Cottonseed: Production, disposition, price, and farm value, United States, 1909-1947, Table 17 54

Cottonseed: Average price per ton received by farmers by months, Louisiana, August 1909-December 1948, Table 18 55

Cottonseed: Average price per ton received by farmers by months, United States, September 1910-December 1948, Table 19 56

Louisiana Cotton Statistics with Comparisons

By

J. P. MONTGOMERY

It is the purpose of this publication to make factual data on cotton lint and cottonseed more readily available to research workers, agricultural teachers and farmers of Louisiana, and thereby, make possible a wider use of such information.

Although the importance of cotton in Louisiana agriculture has declined since 1930, the crop still provides more cash for farmers than any other. Cash receipts from farm marketings of cotton lint and cottonseed amounted to an average of 46 per cent of the total cash receipts from all farm marketings of agricultural products during the ten-year period 1924-1933. The average from the cotton crop for the ten-year period 1939-1948 was only 30 per cent of the total cash income from farm marketings (Table 7).

Another indication of the decline in importance of cotton in the agricultural economy of Louisiana is found in the decline in the number of farms in Louisiana reporting cotton production and in the acreage of cotton reported. Reports indicate that 1,945,354 acres of cotton were grown on 128,537 Louisiana farms in 1930. By 1945 cotton acreage had declined to 811,736 and the number of farms reporting cotton production had declined to 79,319.[1] The decline amounted to 38 per cent in the number of growers and 58 per cent in acres in cotton production.

Because cotton, the highest cash producing crop in Louisiana, is in competition with foreign areas of production and with a rapidly expanding fiber industry, factual data on cotton in a readily available form are in constant demand. A sound appraisal of proposed national policies for cotton with respect to price supports and acreage control is dependent on a knowledge of cotton statistics.

The tables and charts show the fluctuations in acreage, production and price of cotton in Louisiana since 1866 and in the United States since 1790. Domestic and world production, consumption and carryover data for cotton since 1920 are needed in appraising the economic effects of cotton control programs. Persons interested in the best time of year to sell will find the monthly prices for cotton in Louisiana and in the United States valuable. Data on the production, disposition and price of cottonseed in Louisiana and in the United States are included. Altogether these data reflect the present position of the cotton industry in the United States and in the foreign cotton markets.

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[1] U. S. Census of Agriculture, Volume I, Part 24—Louisiana.

Cotton Situation in Recent Years[2]

Significant changes have taken place in both the production and consumption of cotton since World War I. Cotton accounted for 86.5 per cent of the domestic mill consumption of the apparel fibers—cotton, wool, rayon, and silk—in the United States in the late 20's. Rayon and other artificial fibers were in their infancy then and accounted for only 2.5 per cent of the total consumption, wool 8.5 per cent, and silk and flax 2.5 per cent.

By 1948, the proportion of cotton had declined to about 73 per cent of the total consumption of the apparel fibers, while the proportion of rayon had increased to about 16 per cent. Wool had increased to 11 per cent of the total, while silk and flax together had dropped to less than one per cent. The percentage of cotton in the four-fiber total has declined each year since 1942.

Prior to World War II the largest industrial use of cotton in the United States was in the construction of automobile, truck, and airplane tires. In the calendar year 1939, ninety-seven per cent of all tire fabrics and tire cord was of cotton. In 1947, only 60 per cent of the tire fabrics and cord was produced from cotton, the other 40 per cent using rayon in their production. If existing price relationships between rayon and cotton continue, substitution will be even greater when larger quantities of rayon become available.

The 1935-39 consumption of rayon in the United States averaged 2.6 pounds per capita. For the three years 1945-47, the average per capita deliveries had increased to 6.4 pounds, which was 3.8 pounds, or 146 per cent, more than the 1935-39 average. The per capita deliveries in 1947-48 were 7.2 pounds, eight-tenths of a pound, or 12.5 per cent, higher than the average for the previous three years. Deliveries for the calendar year 1948 exceeded one billion pounds for the first time in any one year. One billion pounds of rayon amounts roughly to the equivalent of 2,350,000 running bales of raw cotton. If the domestic mill consumption of cotton during the calendar year 1948 amounted to nine million bales, rayon accounted for over 20 per cent of the combined consumption of the two fibers.

Practically all flour, cement, sugar, and a host of other products were packaged in cotton sacks prior to the depression of the thirties. Now, a large portion of these products are packaged in paper sacks. These are only two of the many uses in which synthetics or other substitutes are competing with cotton for limited markets.

In spite of the decrease in cotton's percentage of the total fiber consumption, the per capita domestic mill consumption of cotton now is higher than it was prior to World War II. From 1911 to 1939 per capita domestic mill consumption of cotton averaged 26.1 pounds, with a high

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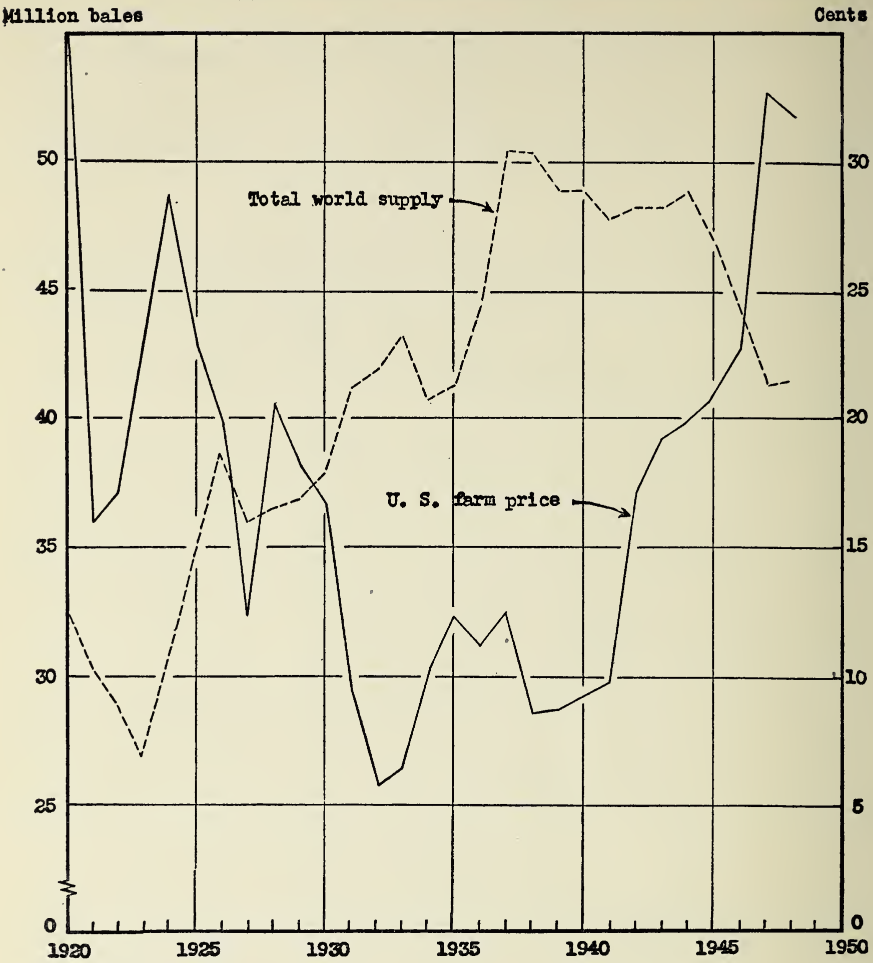
[2] *The Cotton Situation Reports,* Bureau of Agricultural Economics, U.S.D.A.

FIGURE 1. World Supply and United States Farm Price for Cotton, 1920-1948



Source: Tables 1 and 2.

in 1916 of 31.9 pounds and a low in 1931 of 19.1 pounds. The average per capita mill consumption for the three postwar crop years 1945-47 was 32.4 pounds, which is 3.8 pounds, or 13 per cent, above the average for the three pre-war crop years 1937-39. In 1947-48 domestic mill consumption was 31.4 pounds per capita, slightly lower than for either of the two preceding years but 3.7 pounds above the 1927-28 level. At the close of World War II, the domestic demand for cotton textiles by civilians was the highest of record. This demand stemmed from several sources—from consumers in moderate income brackets, whose wardrobes and furnishings had deteriorated during the war; from families that prior to the war were in the low income brackets but during and after the war were in moderate income brackets and spent more on wardrobes and home furnishings.

Some of the recent higher per capita mill consumption in the United States was used to restock inventories at the wholesale and retail levels that in some items had been critically depleted. Exports of cotton textiles during the last three years also have been high, as compared with prewar, accounting for about ten per cent of total domestic mill consumption, whereas the 1935-39 average was only three per cent.

TABLE 1. Commercial Cotton, All Growths: World Supply and Consumption, 1920-48

Year beginning August	Supply					Mill consumption[1]		
	Carry-over Aug. 1			World production	World total supply	United States	Foreign countries	World total consumption
	United States	Foreign countries	World total carry-over					
	1,000 bales[2]	*1,000 bales*[2]	*1,000 bales*[2]	*1,000 bales*[2]	*1,000 bales*[2]	*1,000 bales*[2]	*1,000 bales*[2]	*1,000 bales*[2]
1920....	3,824	7,928	11,752	20,628	32,380	4,893	12,258	17,151
1921....	6,896	8,273	15,169	15,173	30,342	5,910	13,868	19,778
1922....	3,322	7,172	10,494	18,451	28,945	6,666	14,671	21,337
1923....	2,325	5,246	7,571	19,090	26,661	5,681	14,346	20,027
1924....	1,556	5,058	6,614	24,094	30,708	6,193	16,541	22,734
1925....	1,610	6,338	7,948	26,743	34,691	6,456	17,712	24,168
1926....	3,542	6,931	10,473	27,930	38,403	7,190	18,489	25,679
1927....	3,762	8,892	12,654	23,343	35,997	6,834	18,608	25,442
1928....	2,536	7,999	10,535	25,802	36,337	7,091	18,687	25,778
1929....	2,313	8,228	10,541	26,251	36,792	6,106	18,769	24,875
1930....	4,530	7,362	11,892	25,376	37,268	5,263	17,169	22,432
1931....	6,370	8,438	14,808	26,479	41,287	4,866	18,023	22,889
1932....	9,678	8,658	18,336	23,461	41,797	6,137	18,514	24,651
1933....	8,164	8,952	17,116	26,066	43,182	5,700	19,202	25,602
1934....	7,744	9,796	17,540	23,042	40,582	5,361	20,119	25,480
1935....	7,208	7,864	15,072	26,141	41,213	6,351	21,178	27,529
1936....	5,409	8,240	13,649	30,729	44,378	7,950	22,688	30,638
1937....	4,499	9,196	13,695	36,745	50,440	5,748	21,825	27,573
1938....	11,533	11,169	22,702	27,509	50,211	6,858	21,649	28,507
1939....	13,032	8,606	21,638	27,326	48,964	7,784	20,712	28,496
1940....	10,564	9,698	20,262	28,720	48,982	9,722	16,873	26,595
1941....	12,166	10,001	22,167	25,616	47,783	11,170	13,863	25,033
1942....	10,640	11,945	22,585	25,582	48,167	11,100	13,193	24,293
1943....	10,657	12,913	23,570	24,521	48,091	9,943	12,623	22,566
1944....	10,744	14,660	25,404	23,391	48,795	9,568	12,582	22,150
1945....	11,164	15,323	26,487	20,271	46,758	9,163	14,378	23,541
1946[3]....	7,326	15,741	23,067	20,993	44,060	10,035	15,965	26,000
1947[3]....	2,530	15,391	17,921	24,377	42,298	9,347	17,900	27,247
1948[3]....	3,082	11,960	15,042	28,000	42,400	9,000	18,200	27,200

[1] Excludes from 18,000 to 304,000 bales destroyed annually.

[2] American in running bales (counting round bales as half bales) and foreign in bales of approximately 478 pounds net weight.

[3] Preliminary and partly estimated.

Data for war years are tentative and subject to further revisions.

Sources: Supply and Mill consumption, 1920-1946 and Supply for 1947—from the *Cotton Situation*, Outlook Issue—Aug., Sept., Oct., 1947, Table 3, except U.S. carry-over for 1947 which was revised on the basis of data found in the 1949 Outlook issue of the *Cotton Situation*. U. S. Mill consumption for 1947, U. S. carry-over, world production, world total supply and mill consumption for 1948 were taken from the *Cotton Situation*, Outlook Issue, September 1948 (from the discussion). Other data for 1947 and 1948 were estimated.

The higher per capita domestic mill consumption and the larger population since World War II are responsible for a 35 per cent increase in total United States mill consumption of cotton as compared with pre-war. The total domestic mill consumption of cotton for the four postwar seasons 1945-48 averaged 9,386,000 bales annually, 2,448,000 bales more than the average in the five pre-war years 1935-39 (Table 1). On the other hand, world mill consumption averaged 28,548,600 bales in the five-year pre-war period 1935-39 as compared with an average of 25,997,000 bales in the postwar years 1945-48, a decline of 2,511,600 bales, or approximately nine per cent.

Cotton Exports

Prior to the Civil War, the value of the cotton exported from the United States was more than half of the total value of all exports and twice as much as all other agricultural exports. In the 1947-48 season the value of the raw cotton exported amounted to only two per cent of the total value of all exports and to less than ten per cent of all agricultural exports. The 2,500,000 bales exported during the 1947-48 season was the lowest for any peacetime year since 1872 (Table 2). Lack of dollar exchange in cotton importing countries has been one of the major causes of low exports since the close of hostilities. As a general policy, available dollar exchange has been and is being used to import from the United States only those commodities that can not be obtained from countries where European exchange is more readily accepted. During the 1945 and 1946 seasons most countries accumulated substantial stocks of cotton and, as a result, began the 1947 season with carry-overs roughly equivalent to those of 1939. With mill consumption substantially below 1939 levels, these countries were able to finish the season with minimum imports of cotton. Necessary imports were managed by barter with Egypt or India or by direct purchase from those countries willing to accept sterling. As a matter of policy in European countries, stocks of cotton were reduced considerably during 1947-48.

The relative position of countries producing cotton textiles changed materially during World War II. Prior to the war most cotton producing countries, except the United States, exported raw cotton and imported textiles. With exports of cotton cut off by the war and mill activities in importing countries drastically curtailed, at the sacrifice of export trade in textiles, mill consumption in the cotton producing countries was greatly expanded. In 1938 mill consumption in the western hemisphere and India was 11.3 million bales and in 1947 it had increased to 15.2 million bales, an increase of 34.5 per cent. In 1938 total domestic mill consumption in these areas accounted for 59 per cent of total production, but by 1947 this had increased to 87 per cent of their total production. This change is partly responsible for world trade in cotton declining from about 13 million bales annually before the war to approximately nine million bales in 1947.

TABLE 2. Cotton Lint: Production, Supply, Price, Value, and Distribution, United States, 1790-1948

Years	Carry-over[1]	Imports[2]	Production[3]	Total supply[4]	Farm price[5]	Value of production[6]	Consumption[7]	Domestic exports[8]	Destroyed[9]
	1,000 bales	*Bales*	*1,000 bales*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*	*1,000 bales*	*1,000 bales*	*1,000 bales*
1790	....	697	3	....	....	....	3	....	....
1791	....	1,112	4	....	....	....	5	....	....
1792	....	5,503	6	....	....	....	11	1	....
1793	....	5,127	10	....	....	....	12	4	....
1794	....	8,592	17	....	....	....	16	9	....
1795	....	8,737	18	....	....	....	13	12	....
1796	....	7,336	21	....	....	....	21	8	....
1797	....	7,761	23	....	....	....	12	19	....
1798	....	7,532	31	....	....	....	20	19	....
1799	....	8,870	42	....	....	....	15	36	....
1800	....	8,696	73	....	....	....	40	42	....
1801	....	170	100	....	....	....	52	48	....
1802	....	1,153*	115	....	....	....	38	75	....
1803	....	183	126	....	....	....	56	70	....
1804	....	456	136	....	....	....	60	77	....
1805	....	961	146	....	....	....	76	71	....
1806	....	1,485	167	....	....	....	41	128	....
1807	....	6,297	167	....	....	....	152	21	....
1808	....	1,601*	157	....	....	....	53	102	....
1809	....	560	172	....	....	....	16†	187	....
1810	....	431	178	....	....	....	54	124	....
1811	....	897	167	....	....	....	110	58	....
1812	....	3,133	158	....	....	....	122	38	....
1813	....	101	157	....	....	....	122	35	....
1814	....	266*	146	....	....	....	20†	166	....
1815	....	44	209	....	....	....	45	164	....
1816	....	2,048	259	....	....	....	90	171	....
1817	....	3,086	272	....	....	....	90	185	....
1818	....	4,454*	262	....	....	....	81	176	....
1819	....	4,571*	349	....	....	....	89	256	....
1820	....	427	335	....	....	....	85	250	....
1821	....	196*	377	....	....	....	87	289	....
1822	....	110	439	....	....	....	92	347	....
1823	....	932	387	....	....	....	103	285	....
1824	....	26	450	....	....	....	97	353	....
1825	....	79	534	....	....	....	124	409	....
1826	....	74	732	....	....	....	144	589	....
1827	....	597	565	....	....	....	144	421	....
1828	....	40*	680	....	....	....	150	530	....
1829	....	378	764	....	....	....	167	597	....
1830	....	22	732	....	....	....	178	554	....
1831	....	22*	805	....	....	....	161	644	....
1832	....	69	816	....	....	....	167	649	....
1833	....	308	931	....	....	....	162	769	....
1834	....	1,574	962	....	....	....	189	775	....
1835	....	427	1,062	....	....	....	215	847	....
1836	....	510*	1,129	....	....	....	240	888	....
1837	....	355	1,428	....	....	....	237	1,192	....
1838	....	319	1,093	....	....	....	266	827	....
1839	....	297	1,654	....	....	....	166	1,488	....
1840	....	1,210	1,348	....	....	....	288	1,060	....
1841	....	107	1,398	....	....	....	229	1,169	....
1842	....	1,835	2,035	....	....	....	453	1,585	....

(Continued)

TABLE 2—(continued)

Years	Carry-over[1]	Imports[2]	Production[3]	Total supply[4]	Farm price[5]	Value of production[6]	Consumption[7]	Domestic exports[8]	Destroyed[9]
	1,000 bales	*Bales*	*1,000 bales*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*	*1,000 bales*	*1,000 bales*	*1,000 bales*
1843	....	517	1,750	....	....	....	423	1,327	....
1844	....	680*	2,079	....	....	....	332	1,746	....
1845	....	386	1,806	....	....	....	711	1,095	....
1846	....	122	1,604	....	....	....	549	1,054	....
1847	....	558	2,128	....	....	....	500	1,629	....
1848	....	22	2,615	....	....	....	562	2,053	....
1849	....	485	2,216	....	....	....	946	1,271	....
1850	....	330	2,136	....	....	....	282	1,854	....
1851	....	512	2,799	....	....	....	613	2,186	....
1852	....	1,423	3,130	....	....	....	909	2,223	....
1853	....	1,141	2,766	....	....	....	792	1,976	....
1854	....	4,425	2,708	....	....	....	696	2,017	....
1855	....	2,295	3,221	....	....	....	520	2,703	....
1856	....	1,678	2,874	....	....	....	779	2,097	....
1857	....	....	3,012	....	....	....	775	2,237	....
1858	....	....	3,758	....	....	....	985	2,773	....
1859	....	....	5,195	....	....	....	1,660	3,535	....
1860	....	....	3,841	....	....	....	3,226	615	....
1861	....	61,731	4,491	....	....	....	4,542	10	....
1862	....	67,695	1,597	....	....	....	1,642	23	....
1863	....	52,405	449	....	....	....	477	24	....
1864	....	68,798	299	....	....	....	350	18	....
1865	....	10,322	2,094	....	....	....	803	1,301	....
1866	....	2,000	2,097	....	....	....	545	1,323	....
1867	....	2,000	2,520	....	....	....	843	1,511	....
1868	....	6,000	2,366	....	....	....	900	1,288	....
1869	....	4,000	3,011	....	16.5	218,671	788	1,980	....
1870	....	3,000	4,352	....	12.1	232,771	1,104	2,894	....
1871	....	7,000	2,974	....	17.9	235,857	938	1,851	....
1872	....	11,000	3,933	....	16.5	287,949	1,190	2,437	....
1873	....	5,000	4,168	....	14.1	261,083	1,195	2,706	....
1874	....	5,000	3,836	....	13.0	219,247	1,028	2,523	....
1875	....	5,000	4,631	....	11.1	228,299	1,270	3,003	....
1876	....	6,000	4,474	....	9.71	200,791	1,284	2,869	....
1877	....	7,000	4,773	....	8.53	192,217	1,302	3,198	....
1878	....	6,000	5,074	....	8.16	194,224	1,460	3,265	....
1879	....	7,000	5,756	....	10.28	281,784	1,731	3,711	....
1880	....	9,000	6,606	....	9.83	312,925	1,909	4,409	....
1881	....	9,000	5,456	....	10.66	274,440	1,763	3,430	....
1882	....	9,000	6,949	....	9.12	311,644	2,247	4,582	....
1883	....	15,000	5,713	....	9.13	252,501	1,800	3,745	....
1884	....	10,000	5,682	....	9.19	251,581	1,768	3,740	....
1885	....	11,000	6,576	....	8.39	267,481	2,177	4,193	....
1886	....	9,000	6,505	....	8.06	254,733	2,021	4,274	....
1887	....	11,000	7,047	....	8.55	294,527	2,377	4,557	....
1888	....	17,000	6,938	....	8.50	294,183	2,209	4,720	....
1889	....	19,000	7,473	....	8.55	319.334	2,562	4,934	....
1890	....	45,000	8,653	....	8.59	368,108	2,757	5,859	....
1891	....	61,000	9,035	....	7.24	323,943	3,108	5,888	....
1892	....	90,000	6,700	....	8.34	277,556	2,259	4,456	....
1893	....	58,000	7,493	....	7.00	260,096	2,239	5,309	....
1894	....	104,000	9,901	....	4.59	230,071	3,164	7,010	....
1895	....	115,000	7,162	....	7.62	272,378	2,493	4,710	....

(*Continued*)

TABLE 2—(continued)

Years	Carry-over[1]	Im-ports[2]	Pro-duction[3]	Total supply[4]	Farm price[5]	Value of production[6]	Con-sumption[7]	Domestic exports[8]	Des-troyed[9]
	1,000 bales	*Bales*	*1,000 bales*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*	*1,000 bales*	*1,000 bales*	*1,000 bales*
1896	....	119,000	8,533	....	6.66	283,463	2,728	6,172	....
1897	....	102,000	10,899	....	6.68	367,065	3,560	7,757	....
1898	....	105,000	11,278	....	5.73	330,282	3,982	7,662	....
1899	....	140,000	9,346	....	6.98	326,208	3,373	6,228	....
1900	....	109,000	10,124	....	9.15	463,295	3,522	6,800	....
1901	....	202,000	9,508	....	7.03	334,075	2,937	6,949	....
1902	....	151,000	10,630	....	7.60	403,717	4,015	7,084	....
1903	....	103,000	9,851	....	10.49	516,764	3,856	6,207	....
1904	....	129,000	13,438	....	8.98	603,433	4,691	8,908	....
1905	....	144,000	10,576	....	10.78	569,788	3,963	7,118	....
1906	....	227,000	13,274	....	9.58	635,537	....	8,943	....
1907	....	153,000	11,106	....	10.36	575,207	....	7,666	....
1908	....	181,000	13,241	....	9.01	596,611	....	8,955	....
1909	....	170,000	10,005	....	13.52	676,558	....	6,353	....
1910	....	245,000	11,609	....	13.96	810,507	....	8,027	....
1911	....	233,000	15,694	....	9.65	756,989	....	11,116	....
1912	....	249,000	13,703	....	11.50	787,645	....	9,146	....
1913	....	273,000	14,153	....	12.47	882,502	....	9,508	....
1914	....	400,000	16,112	....	7.35	592,192	....	8,702	....
1915	3,936	421,000	11,172	15,529	11.22	626,897	6,397	6,113	95
1916	3,140	289,000	11,448	14,877	17.36	993,514	6,789	5,525	35
1917	2,720	217,000	11,284	14,221	27.09	1,528,535	6,566	4,402	25
1918	3,609	197,000	12,018	15,824	28.88	1,735,227	5,766	5,774	50
1919	4,445	683,000	11,411	16,539	35.34	2,016,075	6,420	6,707	25
1920	3,824	211,000	13,429	17,464	15.89	1,066,759	4,893	5,973	60
1921	6,896	352,000	7,945	15,193	17.00	675,500	5,910	6,348	70
1922	3,322	450,000	9,755	13,527	22.88	1,116,133	6,666	5,007	37
1923	2,325	272,000	10,140	12,737	28.69	1,454,714	5,681	5,815	20
1924	1,556	303,000	13,630	15,489	22.91	1,561,021	6,193	8,240	26
1925	1,610	314,000	16,105	18,029	19.61	1,578,674	6,456	8,267	50
1926	3,542	382,000	17,978	21,902	12.47	1,121,185	7,190	11,299	70
1927	3,762	321,000	12,956	17,039	20.19	1,308,088	6,834	7,857	20
1928	2,536	442,000	14,477	17,455	17.99	1,302,049	7,091	8,419	18
1929	2,313	368,000	14,825	17,506	16.79	1,243,840	6,106	7,035	25
1930	4,530	99,000	13,932	18,561	9.46	658,981	5,263	7,133	28
1931	6,370	107,000	17,097	23,574	5.66	483,575	4,866	9,193	62
1932	9,678	124,000	13,003	22,805	6.52	423,975	6,137	8,895	30
1933	8,164	137,000	13,047	21,348	10.17	663,383	5,700	7,964	40
1934	7,744	107,000	9,636	17,487	12.36	595,572	5,361	5,037	30
1935	7,208	155,000	10,638	18,001	11.09	590,021	6,351	6,267	35
1936	5,409	249,000	12,399	18,057	12.36	766,222	7,950	5,689	45
1937	4,499	158,000	18,946	23,603	8.41	796,469	5,748	5,976	65
1938	11,533	132,000	11,943	23,608	8.60	513,704	6,858	3,512	66
1939	13,033	159,000	11,817	25,009	9.09	536,996	7,784	6,501	73
1940	10,564	188,000	12,566	23,318	9.89	621,284	9,722	1,174	70
1941	12,166	267,000	10,744	23,177	17.03	914,313	11,170	1,162	50
1942	10,640	170,000	12,817	23,627	19.04	1,219,716	11,100	1,498	60
1943	10,657	135,000	11,427	22,219	19.88	1,135,605	9,943	1,146	50
1944	10,744	190,000	12,230	23,164	20.73	1,267,857	9,568	1,909	50
1945	11,164	343,000	9,015	20,522	22.52	1,014,823	9,163	3,678	60
1946	7,326	259,000	8,640	16,225	32.64	1,409,671	10,025	3,500	16
1947	2,530	232,000	11,857	14,619	31.90	1,889,465	9,347	2,500	....
1948	3,082	250,000	14,937	18,269	....	....	9,000	4,000	....

*Excess of foreign exports over total imports.
†Excess of domestic exports over production and net imports.

Sources: See following page.

Sources of data, Table 2. Compiled from U. S. Department of Agriculture releases as follows:

[1]*Carry-over*: 1915-1919 from *Agricultural Statistics*, 1942, Table 143.
1920-1936 from *Cotton Situation*, Outlook Issue, Aug., Sept., Oct. 1947, Table 3.
1937-1947 from *Agricultural Statistics*, 1947, Table 95.
1948 from *Cotton Situation*, Outlook Issue, September 1948.

[2]*Imports*: 1790-1865 from *Yearbook of Agriculture*, 1906, page 601.
1866-1898 from *Agricultural Statistics*, 1939, Table 137.
1899-1914 from *Agricultural Statistics*, 1942, Table 136.
1915-1936 from *Agricultural Statistics*, 1942, Table 143.
1937-1946 from *Agricultural Statistics*, 1947, Table 95.
1947-1948 from *Cotton Situation*, Outlook Issue, September 1948.

[3]*Production*: 1790-1865 from *Yearbook of Agriculture*, 1906, page 601.
1866-1898 from *Agricultural Statistics*, 1939, Table 137.
1899-1928 from *Agricultural Statistics*, 1942, Table 136.
1929-1945 from *Agricultural Statistics*, 1947, Table 89.
1946 from *Cotton Production*, 1947, published May 7, 1948.
1947-1948 from Dec. 1 Cotton Report, La. Office of Agricultural Estimates, B. A. E.

[4]*Total Supply*: 1915-1948—sum of carry-over, imports, and production. Does not check with "total supply" in the tables on "supply and distribution" shown in *Agricultural Statistics* because those tables included "ginnings in season" rather than "production" to obtain "total supply."

[5]*Farm Price*: 1869-1875 from *Yearbook of Agriculture*, 1906, page 601.
1876-1898 from *Agricultural Statistics*, 1939, Table 137.
1899-1928 from *Agricultural Statistics*, 1942, Table 136.
1929-1945 from *Agricultural Statistics*, 1947, Table 89.
1946-1947 from *Cotton Production*, 1947, published May 7, 1948.

[6]*Value of production*: 1869-1875 from *Yearbook of Agriculture*, 1906, page 601.
1876-1898 from *Agricultural Statistics*, 1939, Table 137.
1899-1928 from *Agricultural Statistics*, 1942, Table 136.
1929-1945 from *Agricultural Statistics*, 1947, Table 89.
1946-1947 from *Cotton Production*, 1947, published May 7, 1948.

[7]*Consumption*: 1790-1905 from *Yearbook of Agriculture*, 1906, page 601.
1906-1914—not available.
1915-1936 from *Agricultural Statistics*, 1942, Table 143.
1937-1946 from *Agricultural Statistics*, 1947, Table 195.
1947-1948 from *Cotton Situation*, Outlook Issue, September 1948.

[8]*Domestic exports*: 1792-1865 from *Yearbook of Agriculture*, 1906, page 601.
1866-1898 from *Agricultural Statistics*, 1939, Table 137.
1899-1928 from *Agricultural Statistics*, 1942, Table 136.
1929-1945 from *Agricultural Statistics*, 1947, Table 89.
1946-1947 from *Cotton Situation*, Outlook Issue, Aug., Sept., Oct., 1947.
1948 from *Cotton Situation*, Outlook Issue, September 1948.

[9]*Destroyed*: 1915-1928 from *Agricultural Statistics*, 1942, Table 143.
1929-1946 from *Agricultural Statistics*, 1947, Table 95.

Cotton Production Changes

Cotton production since 1925 has been characterized by substantial decreases in acreage and material increases in yield per acre and also a considerable shift in the location of production. Cotton acreage harvested in the United States has fluctuated from a high of 44,608,000 in 1926 to 17,241,000 acres in 1945, which was the smallest acreage since 1884 (Table 3). The highest harvested acreage of cotton of record in Louisiana was 1,953,000 for the year 1930. The 800,000 acres harvested in Louisiana in 1946 was the smallest acreage since 1869 (Table 4).

The average harvested acreage of cotton in the United States in the years 1943-47 was only 48 per cent as large as the average during the 1928-32 period. However, the average production in the 1943-47 period was 73 per cent as great as in 1928-32. Lint yields per acre increased from an average of 173.9 pounds per harvested acre in 1928-32 to 260.1 pounds in 1943-47, an increase of 86.2 pounds, or approximately 50 per cent.

The average harvested acreage of cotton in Louisiana in the period 1943-47 was only 42 per cent as large as the average in 1928-32, while the average production was 66 per cent as great in the latter period as in the former. Lint yields per acre in Louisiana increased from an average of 192.8 pounds per harvested acre in 1928-32 to an average of 268.4 pounds in 1943-47, an increase of 75.6 pounds, or approximately 39 per cent (Table 4).

Changes in acreage and yield per acre have been much greater in some areas than in others. In the Deltas, the High Plains, and in the irrigated areas of the West, production was 11, 20, and 74 per cent greater, respectively, in 1943-47 than in 1928-32 (Table 5). In the sandy land areas of east Texas, south Arkansas, and in the uplands of North Louisiana and in some areas in Oklahoma, cotton production was only 30 per cent as large in 1943-47 as the average in 1928-32. The irrigated areas and the Deltas accounted for 7.5 and 24 per cent, respectively, of the United States production in 1943-47 as compared with 3.1 per cent and 15.7 per cent, respectively, in 1928-32. The proportion produced in sandy land areas decreased from 8.5 per cent of the total in 1928-32 to 3.4 per cent in 1943-47.

Among the more important factors contributing to higher yields per acre are better selection and increased use of fertilizer, improved cultural practices, more effective insect control, better planting seed, and the shifting of acreage to higher yielding areas. The latter accounts for an estimated 30 per cent of the increase in yields between the 1928-32 and 1943-47 periods.

These shifts in the acreage and production of cotton have been caused largely by changes in the relative profitableness of cotton and other farm enterprises which have in turn been affected by such factors as technological developments, changes in the availability of farm labor and in farm wage rates, off-farm employment opportunities, and changes in the price of cotton and the prices of products of alternative enterprises.

TABLE 3. Cotton: Acreage, Yield, Production, Price, and Farm Value, United States, 1866-1947

Year beginning August	Harvested acreage	Yield per acre	Production	Price received by farmers[1]	Value of production
	1,000 acres	*Pounds*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*
1866	7,666	121.5	2,097	....	....
1867	7,864	142.6	2,520	....	....
1868	6,973	150.7	2,366	....	....
1869	7,751	155.4	3,011	16.5	218,671
1870	9,238	208.2	4,352	12.1	232,771
1871	8,285	159.0	2,974	17.9	235,857
1872	9,380	182.3	3,933	16.5	287,949
1873	10,998	168.3	4,168	14.1	261,083
1874	10,753	157.0	3,836	13.0	219,247
1875	11,348	181.2	4,631	11.1	228,299
1876	11,747	167.6	4,474	9.71	200,791
1877	12,606	170.4	4,773	8.53	192,217
1878	13,539	167.5	5,074	8.16	194,224
1879	14,474	180.5	5,756	10.28	281,784
1880	15,921	190.9	6,606	9.83	312,925
1881	16,483	149.0	5,456	10.66	274,440
1882	15,638	208.9	6,949	9.12	311,644
1883	16,295	162.0	5,713	9.13	252,501
1884	16,849	155.1	5,682	9.19	251,581
1885	17,922	169.9	6,576	8.39	267,481
1886	18,370	164.3	6,505	8.06	254,733
1887	18,793	175.1	7,047	8.55	294,527
1888	19,520	169.5	6,938	8.50	294,183
1889	20,191	176.9	7,473	8.55	319,334
1890	20,937	195.5	8,653	8.59	368,108
1891	21,503	198.7	9,035	7.24	323,943
1892	18,869	168.7	6,700	8.34	277,556
1893	20,256	175.3	7,493	7.00	260,096
1894	21,886	219.0	9,901	4.59	230,071
1895	19,839	172.2	7,162	7.62	272,378
1896	23,230	175.2	8,533	6.66	283,463
1897	25,131	209.0	10,899	6.68	367,065
1898	24,715	223.1	11,278	5.73	330,282
1899	24,163	185.0	9,346	6.98	326,208
1900	24,886	194.7	10,124	9.15	463,295
1901	27,050	168.2	9,508	7.03	334,075
1902	27,561	184.7	10,630	7.60	403,717
1903	27,762	169.9	9,851	10.49	516,764
1904	30,077	213.7	13,438	8.98	603,433
1905	27,753	182.3	10,576	10.78	569,788
1906	31,404	202.3	13,274	9.58	635,537
1907	30,729	172.9	11,106	10.36	575,207
1908	31,091	203.8	13,241	9.01	596,611
1909	30,555	156.5	10,005	13.52	676,558
1910	31,508	176.2	11,609	13.96	810,507

(Continued)

TABLE 3—(continued)

Year beginning August	Harvested acreage	Yield per acre	Production	Price received by farmers[1]	Value of production
	1,000 acres	*Pounds*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*
1911	34,916	215.0	15,694	9.65	756,989
1912	32,557	201.4	13,703	11.50	787,645
1913	35,206	192.3	14,153	12.47	882,502
1914	35,615	216.4	16,112	7.35	592,192
1915	29,951	178.5	11,172	11.22	626,897
1916	33,071	165.6	11,448	17.36	993,514
1917	32,245	167.4	11,284	27.09	1,528,535
1918	35,038	164.1	12,018	28.88	1,735,227
1919	32,906	165.9	11,411	35.34	2,016,075
1920	34,408	186.7	13,429	15.89	1,066,759
1921	28,678	132.5	7,945	17.00	675,500
1922	31,361	148.8	9,755	22.88	1,116,133
1923	35,550	136.4	10,140	28.69	1,454,714
1924	39,501	165.0	13,630	22.91	1,561,021
1925	44,386	173.5	16,105	19.61	1,578,674
1926	44,608	192.9	17,978	12.47	1,121,185
1927	38,342	161.7	12,956	20.19	1,308,088
1928	42,434	163.3	14,477	17.99	1,302,049
1929	43,232	164.2	14,825	16.78	1,243,840
1930	42,444	157.1	13,932	9.46	658,981
1931	38,704	211.5	17,097	5.66	483,575
1932	35,891	173.5	13,003	6.52	423,975
1933	29,383	212.7	13,047	10.17	663,383
1934	26,866	171.6	9,636	12.36	595,572
1935	27,509	185.1	10,638	11.09	590,021
1936	29,755	199.4	12,399	12.36	766,222
1937	33,623	269.9	18,946	8.41	796,469
1938	24,248	235.8	11,943	8.60	513,704
1939	23,805	237.9	11,817	9.09	536,996
1940	23,861	252.5	12,566	9.89	621,284
1941	22,236	231.9	10,744	17.03	914,313
1942	22,602	272.4	12,817	19.04	1,219,716
1943	21,652	253.5	11,427	19.88	1,135,605
1944	20,009	293.5	12,230	20.73	1,267,857
1945	17,241	251.0	9,015	22.52	1,014,823
1946	17,615	235.3	8,640	32.64	1,409,671
1947	21,269	267.2	11,851	31.90	1,889,465

[1] Price before 1908 as of Dec. 1.

Source: 1866 through 1923—Acreage, yield, and production from *The World Cotton Situation*, Part II, "Cotton Production in the U. S.", B.A.E., U.S.D.A., Pub. Feb. 1936. Price and value 1869 through 1875 from *Yearbook of Agriculture*, 1906, page 602. Price and value 1876 through 1923 from *Agricultural Statistics*, 1939.

1924 through 1928 from *Agricultural Statistics*, 1942.

1929 through 1945 from *Agricultural Statistics*, 1946.

1946 through 1947 from *Cotton Production*, "Cotton and Cottonseed Production, 1947." Mimeographed release of B.A.E., U. S. Department of Agriculture, May 1948.

TABLE 4. Cotton Lint: Acreage, Yield, Production, Price, and Farm Value, Louisiana, 1866-1948

Year beginning August	Harvested acreage	Yield per acre	Production[1]	Price received by farmers[2]	Value of production[3]
	1,000 acres	*Pounds*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*
1866	1,020	57	131	....	....
1867	844	88	167	....	....
1868	652	169	248	....	....
1869	767	183	351	16.5	27,683
1870	932	269	567	12.1	32,794
1871	868	172	337	17.9	28,834
1872	980	228	503	16.5	39,672
1873	1,039	194	454	14.1	30,599
1874	975	242	536	13.0	33,307
1875	1,000	306	689	11.1	36,557
1876	899	276	564	9.71	26,177
1877	991	266	586	8.53	23,893
1878	961	215	462	8.16	18,020
1879	865	267	509	10.28	25,012
1880	920	187	374	9.83	17,573
1881	948	223	470	10.66	23,949
1882	900	292	559	9.12	24,369
1883	995	228	491	9.13	21,428
1884	926	241	485	9.19	21,305
1885	1,009	224	488	8.39	19,571
1886	1,052	210	476	8.06	18,339
1887	1,122	211	507	8.55	20,721
1888	1,232	173	447	8.50	18,162
1889	1,270	248	659	8.55	26,933
1890	1,288	231	629	8.59	25,827
1891	1,320	273	762	7.24	26,371
1892	1,140	180	432	8.34	17,222
1893	1,218	184	473	7.00	15,827
1894	1,272	287	754	4.59	16,543
1895	1,162	211	514	7.62	18,722
1896	1,258	215	567	6.66	18,050
1897	1,381	275	788	6.68	25,161
1898	1,378	257	724	5.73	19,830
1899	1,378	243	700	6.98	23,355
1900	1,480	228	706	9.15	30,878
1901	1,603	251	840	7.03	28,227
1902	1,632	259	882	7.60	32,041
1903	1,640	241	825	10.49	41,367
1904	1,836	284	1,090	8.98	46,788
1905	1,565	157	513	10.78	26,434
1906	1,637	289	988	9.58	45,243
1907	1,548	209	675	10.36	33,427
1908	1,380	163	470	9.01	20,242
1909	931	130	253	13.38	16,953
1910	870	135	246	14.00	17,195
1911	938	196	385	9.63	18,518
1912	922	195	376	11.38	21,400

(*Continued*)

TABLE 4—(continued)

Year beginning August	Harvested acreage	Yield per acre	Production[1]	Price received by farmers[2]	Value of production[3]
	1,000 acres	*Pounds*	*1,000 bales*	*Cents per lb.*	*1,000 dollars*
1913	1,117	190	444	12.23	27,140
1914	1,220	176	449	7.64	17,169
1915	916	178	341	10.94	18,656
1916	1,127	188	443	16.82	37,272
1917	1,252	244	639	26.39	84,280
1918	1,441	195	588	28.54	83,867
1919	1,304	109	298	35.78	53,255
1920	1,243	149	388	16.80	32,564
1921	1,009	132	279	15.85	22,099
1922	1,032	159	343	22.50	38,618
1923	1,255	140	368	27.70	50,952
1924	1,427	165	493	22.05	54,315
1925	1,727	252	910	19.28	87,769
1926	1,802	220	829	12.47	51,714
1927	1,448	181	548	19.94	54,638
1928	1,836	180	691	17.77	61,392
1929	1,934	200	809	16.45	66,526
1930	1,953	175	715	9.33	33,333
1931	1,825	236	900	5.57	25,063
1932	1,688	173	611	6.74	20,574
1933	1,295	176	477	10.24	24,404
1934	1,160	195	485	12.46	30,195
1935	1,268	210	556	10.97	30,512
1936	1,401	260	761	12.44	47,343
1937	1,569	337	1,104	8.40	46,352
1938	1,119	289	676	8.55	28,904
1939	1,120	319	745	9.02	33,584
1940	1,130	194	456	9.70	22,093
1941	1,014	148	313	17.19	26,886
1942	1,001	285	593	18.76	55,602
1943	1,020	349	739	19.54	72,172
1944	938	321	625	20.78	64,938
1945	804	232	387	22.60	43,698
1946	800	148	247	33.16	40,949
1947	830	292	505	32.43	81,782
1948	933	392	760	31.40	119,320

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[1] Running bales for the years 1866-1898; 478 lb. net weight or 500 lb. gross weight bales beginning 1899.

[2] U. S. prices from 1869-1908; prices for Louisiana are not available.

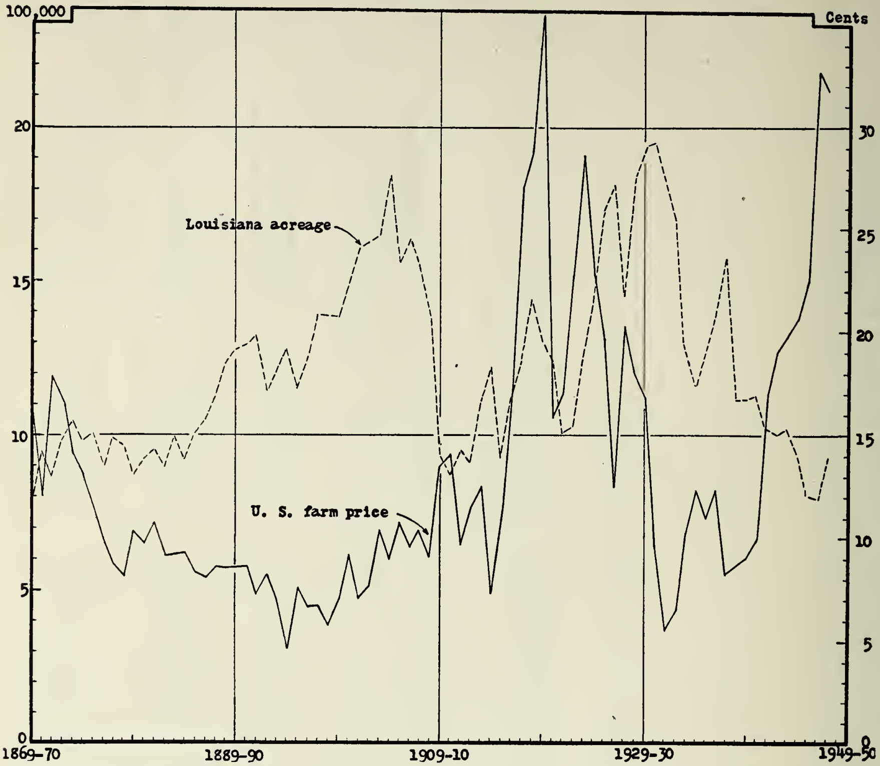
[3] U. S. farm price multiplied by Louisiana production for the years 1869-1908 (bales 478 pounds net weight).

Source: 1866-1908—Acreage, yield, and production from *The World Cotton Situation*, Part II, "Cotton Production in the U. S." B.A.E., U.S.D.A., Published February 1936.

1909-1943—from Department of Agricultural Economics Mimeograph Circular No. 49, by J.P. Montgomery, "Production, Prices, and Value of Selected Crops, Livestock and Livestock Products in Louisiana, 1910-1944."

1944-1948—from releases by the Louisiana Office of Agricultural Estimates, B.A.E., U.S.D.A.

FIGURE 2. Acreage of Cotton in Louisiana and United States Farm Prices per Pound for Cotton Lint, 1869-1948



Source: Tables 3 and 4.

TABLE 5. Trends in Cotton Acreage, Yield and Production by Cotton Production Areas in the United States

Cotton production area	Percent of 1928-32 average								
	1943-47 average			1938-42 average			1933-37 average		
	Acreage	Yield	Production	Acreage	Yield	Production	Acreage	Yield	Production
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Irrigated	120	142	174	124	140	173	116	128	153
High Plains	76	145	120	85	138	118	95	107	112
Delta	68	163	111	69	172	119	81	126	102
Eastern Hilly	57	168	95	62	143	89	77	124	95
Gulf Coastal Prairies	57	134	76	63	116	72	82	98	81
Coastal Plains	42	153	65	61	121	73	77	129	100
Piedmont	45	142	64	58	125	72	74	112	82
Low Plains	44	103	47	51	124	65	76	92	69
Texas Blacklands	46	100	46	51	106	54	75	96	73
Texas Grazing	35	129	46	50	111	57	78	89	72
Ozark-Ouachita Mountains and Valleys	33	128	42	51	151	78	73	90	67
Sandy Lands	26	111	29	48	113	56	71	101	72
Cross Timbers	25	107	28	46	133	63	84	86	74
Oklahoma Prairies	27	99	27	43	129	56	75	74	58

Source: Work sheet used in 1948 Outlook Conference.

Cotton Carry-over

The carry-over situation has changed materially during the last few years. Total world carry-over of cotton increased irregularly from 6,614,000 bales in 1924 to a high of 26,487,000 bales at the beginning of the 1945 season (Table 1). Since 1945 the carry-over has declined until the estimated world carry-over at the beginning of the 1948 season was 15,042,000 bales. The lowest carry-over in the United States in recent years was 1,556,000 bales in 1924 and the highest carry-over of record was 13,032,000 bales in 1939. The carry-over in the United States was 3,082,000 bales at the beginning of the 1948 season. It can thus be seen that a large part of the decline in cotton carry-over of the last few years occurred in the United States. Heavy domestic cotton consumption plus exports coupled with relatively low production during and immediately after World War II had reduced the carry-over in the United States from a high of 13 million bales in 1939 to 2.5 million bales in 1947.

On August 1, 1948, the cotton carry-over in the United States was slightly more than three million bales. This is only one-half million bales more than for the previous year, which was the lowest since 1929 (Table 1). Disappearance of United States cotton from August 1, 1948, through July 31, 1949, is expected to be about 13 million bales. Primarily because of the record yield per acre in 1948, the carry-over in the United States on August 1, 1949, is expected to increase to about six million bales. Under existing legislation marketing quotas are very likely to be proclaimed for the 1950 crop unless the acreage in 1949 is considerably smaller than in 1948 or unless yields per acre in 1949 are materially below the average for the past several years.

Cotton Prospects for the Future

The level of domestic mill consumption of cotton in the future will depend on many variable factors, some of which are: the level of industrial production and disposable income, the supply of rayon, the price relationship between raw cotton and rayon, new or increased uses of cotton, the extent to which foreign markets for cotton textiles are maintained, the governmental price support policy for cotton as compared with price supports for other agricultural products, etc., etc.

The level of industrial production affects the level of cotton consumption both directly and indirectly. Something like 40 per cent of the cotton consumed is used in the production of industrial goods. The remaining 60 per cent is equally divided between production of household goods and wearing apparel. Therefore, when industrial production and disposable incomes are at high levels, the level of cotton consumption, on a per capita basis, is likely to be high.

It is doubtful if the per capita consumption of cotton will continue as high as the 1947 rate of 32.2 pounds. The supply of rayon and other synthetic fibers will become more plentiful as a result of expansion of productive capacity already under way. It is probable that, unless considerable technological improvements are made in the manufacture of cotton textiles and unless the ratio of the price of raw cotton to rayon staple fiber is greatly reduced, the substitution of rayon for cotton will continue to increase indefinitely.

As foreign textile mills are rehabilitated, exports of cotton textiles from this country will be reduced. When these exports revert to their pre-war proportion domestic mill cotton consumption in the United States will decline by three quarters of a million to a million bales. It is doubtful whether this will be offset with any appreciable increase in exports of raw cotton from the United States.

New uses for cotton, such as insulation and plastic laminates, are being developed from time to time. These new uses may offset to some extent the decreases in cotton consumption due to the inroads of rayon and other synthetic fibers and the reduction in exports of cotton textiles. All indications are for a decline in the per capita mill consumption of cotton in the United States in the years ahead.

Prospective Exports

Exports of raw cotton from the United States in the next few years will depend to some extent on how much of Marshall Plan funds are used for the rehabilitation of the cotton textiles industry in Europe. Proposed volumes of exports to the participating countries are about 2,500,000 bales annually for the life of the program. These quantities to some extent represent the amount of cotton thought likely to be available for export after domestic requirements are satisfied and allowances are made for Canada and other usual buyers of cotton in the United States. If production in this country continues at or near the 1948 production level, it is probable that producers will be faced with materially lower prices within the forseeable future.

Pre-war Europe and Japan were large producers and consumers of synthetic fibers. The major portion of the European production was in Germany and Italy where the substitution of rayon for cotton was governmental policy. Production of synthetic fibers since the war has been much less in Europe because of war damage to plants and because of shortages of coal and wood pulp. The demand for cotton, therefore, has been greater than pre-war. It is only a question of time until these and other countries will return to the production of these substitutes at the pre-war rate or possibly greater, thereby taking an even greater share of the market away from cotton.

Export of United States cotton, after the various economic assistance programs financed by the United States end, will depend on a considerable number of factors. The ability of the European countries and Japan to pay for cotton in dollar exchange will be one of the major problems. Even now, while the United States is supplying billions of dollars for the relief and rehabilitation of Europe, the countries receiving the Marshall Plan aid are buying all products they can from countries other than the United States, where they can buy without using the dollar exchange. They are doing this in attempts to improve their dollar exchange supply position. The future of these countries as importers of cotton will depend on their economic rehabilitation and their ability to reestablish their export trade in cotton textiles and other exportable goods. It is probable that any future expansion of European countries' textile trade will tend to reduce textile export by the United States, thereby reducing mill consumption in this country. The price of United States cotton in relation to that of foreign cotton also will be an important factor in determining the volume of exports of United States cotton.

The extent of the expansion in the production of rayon will affect the requirements for imported cotton in foreign countries. Expansion in cotton production in the minor producing countries will resume its pre-war tendency as a result of exchange difficulties and bilateral trade agreements. The United Kingdom is already encouraging expansion of cotton production in areas under her influence. It is possible that such expansion will not be great, but any expansion will be reflected in smaller demand for American cotton. However, expansion of production in other producing areas will be influenced by the price policy practices in the United States. When cotton price is supported above world prices it encourages expansion in other producing areas in competition with the United States. In the long run, the United States could conceivably price herself entirely out of her export market.

Future Cotton Production

Factors that will affect the production of cotton in the United States in the future include: (1) the supply of farm labor and wage rates, (2) mechanization and other technological developments, (3) the comparative returns from cotton and alternative operations in the various cotton producing areas, and (4) government programs, particularly those designed for cotton. Price of cotton is always an important factor. Price affects and is affected by the above and many other factors. Weather as well as insect infestation and plant diseases as they affect yield from year to year are also important.

The Labor Supply

During and since World War II, the relative shortage of labor and resulting high farm wage rates have been important factors in keeping cotton acreage below that of pre-war. Farm employment has been declining in the major cotton producing areas for the past ten years. The downward trend in farm employment has been due in part to more favorable non-farm employment opportunities. Since the outbreak of World War II, many farm workers have been attracted to better paying jobs in industry. On the other hand farm labor requirements have been reduced by the mechanization of farm operations and the shifts to other land uses demanding less labor than cotton production. In recent years the difficulty in securing labor when needed, together with the higher wage rates, has caused farmers to adopt more highly mechanized practices, to shift to other enterprises, and in other ways to reduce their dependence on hired labor.

From 1929 to 1947 the average annual rate of decline in farm employment averaged approximately one per cent in the ten leading southern cotton producing states. The rate of decline since 1939 has been about 1.3 per cent.

The relative profitableness and availability of non-farm employment will have an important effect on the number of workers available for agricultural work in the future. The rapid expansion in industrial activities under way in the South in recent years apparently will continue for a time. If it does, non-farm employment opportunities will cut further into the labor supply and thereby encourage more rapid mechanization of the cotton enterprise in areas where adapted and a shift to other crops requiring less labor in other areas. An indication that this industrial expansion is continuing, and will continue, in Louisiana is presented in the recent announcement by the Louisiana Department of Industry that a total of 306 applications for tax exemption were granted during 1948. They involved $213,631,459 in new plant construction and equipment and provided employment for an estimated 15,750 additional workers.

Mechanization and Other Technological Developments

Mechanization of the cotton enterprise has lagged behind that of other major crops. This is due in part to the fact that efficient machinery has not been developed for performing the peak labor operations—chopping and harvesting. Mechanization of land preparation and planting has increased rapidly in recent years. Numbers of tractors on southern farms more than doubled from 1940 to 1947. The number of tractors per thousand harvested acres of cropland increased from 2.4 in 1940 to 5.5 in 1947. Further indication of the increased use of tractor power in cotton production is the increase in the proportion of land preparation, planting and cultivation of cotton with tractor equipment. Approximately 60 per cent of land preparation and 45 per cent of cotton cultivation was performed with tractors in 1946. This is about twice the proportion handled with tractor power in 1940. This trend has been influenced in recent years by the scarcity of labor, high wage rates and the fact that some farm operations could be completely mechanized. Increased mechanization and higher yields per acre have reduced the man labor requirements per bale of cotton about one-third during the last 20 years.

Many new technological developments are in the experimental and proving stages and many of the older ones are being adopted more generally. Mechanical cotton pickers, strippers, flame cultivators, mechanical choppers and other mechanical weed control techniques are in limited use already. Extensive experiments in the use of chemicals for weed and grass control are being conducted. Many new technological developments are under way. Many research studies are under way in the field of technological improvements in cultivation and harvesting practices in the South. Only broad guesses and generalizations can be made at this time as to future progress. At the present time, mechanical harvesters are not of major importance in cotton production. It is probable that not more than five per cent of the 1948 cotton crop was harvested mechanically, and most of this was done with strippers. Up to 1948 there was only one implement company engaged in mass production of a mechanical picker. An estimated 1,500 mechanical pickers were in operation in harvesting the 1948 crop of cotton. Other implement companies are doing experimental work with cotton pickers, some of which are being tested under various field conditions. Some of these machines may prove to be as good or even better than the machines now in use. It is doubtful whether sufficient numbers of cotton picking machines will be available in the next several years to harvest any substantial portion of the crop.

Most of the mechanical pickers are in use in the Delta areas and in California where operations are large, the land is level, and where the gins have been equipped to handle machine-harvested cotton. The initial cost of the pickers is about $7,500 or $8,000 including the tractor. The grades of cotton picked by mechanical pickers are lower than grades of cotton picked by hand. Even so, preliminary results of a study in 1947 in the Delta Area of Mississippi indicate its use is economically feasible when wages for hand picking are $2.50 or more per hundred pounds of seed cotton. Fuller and more expert use of the picker probably will increase the competitive position of the machine compared with hand harvesting. The use of mechanical harvesters is expected to expand but at a fairly slow rate, first on the larger farms in high yielding areas. The rate of adoption will depend to some degree upon technological improvements in and the price of the machine but perhaps more on the supply of labor and the wage rate as well as upon the geographical distribution of the cotton acreage. The rate of adoption and use will be faster if full employment and a high level of economic activity continues for a considerable time. Continued high prices for cotton would cause more rapid mechanization in cotton farming.

A large portion of the mechanical strippers operated in 1948 were in the High Plains area of Texas where an estimated 3,000 machines harvested about 15 per cent of the crop. Preliminary reports on studies of mechanical stripper operations indicate that, with a wage of about $2.00 per hundred pounds of seed cotton and trash, the returns per acre over harvesting costs were greater with machine stripping than with hand snapping. The difference is even greater in favor of machine stripping for cotton harvested after frost because after that time there is no significant difference in grade of cotton or in harvesting waste between hand snapping and mechanical stripping. However, the grades of cotton harvested before frost are considerably better than grades of cotton harvested after frost. Normally about 60 per cent of the crop is harvested before frost. A satisfactory artificial defoliant would lessen this grade difference and would prove a great stimulus to increased use of the mechanical stripper.

The following conditions in the High Plains where hand snapping is now the prevailing method of harvesting are favorable to strippers: (1) the short growing season and the variety of cotton grown is conducive to uniform maturity; (2) the vegetative growth is small and the stalk is low; (3) because of relatively low rainfall, weed and grass control is not a serious problem; (4) gins are equipped to handle roughly harvested cotton; and (5) cotton production, except for the harvesting, is highly mechanized. This is the only major cotton producing area where conditions are so favorable to machine harvesting. Conditions in parts of southwestern Oklahoma and in the Low Plains of Texas are fairly similar to those in the High Plains, and therefore, mechanical stripping may expand in those areas, but not as soon nor as rapidly as in the High Plains.

Strippers are being tried in a limited way in the Piedmont area of North Carolina. The cotton stalk does not grow tall in this area and weed control is a smaller problem than in some other areas. The stripper appears to have possibilities in the Piedmont area, particularly for harvesting after frost. The areas mentioned are not the only ones where mechanical harvesting may be adopted but they are the areas where adjustments toward complete mechanization likely will expand more rapidly in the next few years.

In the humid areas, weed and grass control has been a retarding factor in complete mechanization. But by combinations of various methods such as rotary hoes, mechanical choppers, flame cultivators and chemicals, labor requirements are being reduced.

In addition to mechanization, other improved production techniques are increasing in importance. A larger proportion of farmers than ever before are using fertilizer on cotton and at greatly increased rates per acre. On a per planted acre basis, the application of fertilizer was 50 per cent greater in 1948 than during the pre-war period 1938-42. Even so, on most farms where the land responds favorably to fertilizer, experimental data indicate that the point of diminishing financial returns has not been reached under existing relationships between prices of fertilizer and cotton. New and more effective insecticides are being developed and more farmers are adopting insect control programs. Higher yielding varieties and strains of planting seed are being developed. All of these developments point toward a continuation of the upward trend in yields per acre. Assuming average weather, an average yield of 275 pounds of lint per planted acre might be expected in the future. Lint yields averaged 256 pounds during the 1943-47 period. The December 1, 1948, cotton report estimates the United States average yield per harvested acre in 1948 at 311.5 pounds per acre.

Alternatives to Cotton Production

Cotton's importance in farming systems varies considerably among production areas and between farms within an area. Trends in acreage and production, by areas, during the past 20 years provide an indication of the changes in relative profitableness of cotton and other alternatives, including non-farm employment, under conditions encountered during this period. In considering the future of cotton two questions should be considered: (1) will the factors which were responsible for these changes continue in effect in the future, with about the same intensity, and (2) what effects might new factors, not important in the past, have on cotton production in the future?

As previously stated, several production areas, such as the Western irrigated areas, the High Plains areas, and the Deltas, have experienced considerable increases in cotton acreages and yields (Table 5). Furthermore, mechanization has advanced further in these areas than other areas. It is possible that cotton will continue to have a high comparative advantage over other crops in these areas. It is probable that acreage in cotton in these areas will continue to increase when cotton acreage allotments are not in effect.

In some sections of the Coastal Plains of the Southeast in recent years, peanuts have been relatively more profitable than cotton and are being grown on land formerly planted in cotton. This shift is due partially to relative yield and partially to the favorable prices of peanuts compared with cotton. If the peanut-cotton price relationship reverts to that of the pre-war period, cotton may regain its relative advantage and some of the acreage lost to peanuts probably will be returned to cotton.

In some sections of the Low Plains areas of Texas and Oklahoma, wheat acreage has expanded, thereby reducing the cotton acreage in recent years. This was caused, in part at least, by the fact that wheat production is highly mechanized, and in part by the scarcity of labor and high wage rates for harvesting cotton.

The importance of livestock in farming systems has been increasing rapidly in the South. Many farmers have shifted to more diversified types of farming.

In many areas non-farm employment has been the chief competitor of cotton in bidding for the labor resources. It is probable that this condition will continue at least until there is a moderate or severe general economic depression. The increased industrialization which is occuring in the South will not only provide off-farm employment opportunities for farm people but also will furnish an expanded market outlet for locally produced farm products used in family living for those engaged in the new and expanded industrial production.

In some areas a considerable amount of land formerly planted to cotton has been abandoned. Some of this land has been restocked with young trees. Some abandoned farm land has been bought by timber companies and other investors who are holding it for timber production. It is for the best interest of all concerned that these lands not be returned to cotton production.

Government Programs

Government programs probably will have an important effect on cotton production and consumption in the future. Under the provisions of the Agricultural Act of 1948 price support for cotton will be continued. The present parity formula will be in effect for the 1949 crop but the support price will be 90 per cent of parity instead of 92.5 per cent as in 1948. In 1950 and subsequent years prices will be supported at not less than 60 per cent nor more than 90 per cent of parity, depending on the level of supply. If acreage allotments are in effect at the beginning of the marketing year, support prices will be increased by 20 per cent but not to exceed 90 per cent of parity.

From the 1948 cotton crop of approximately 15 million bales, the carry-over from this year's crop on August 1, 1949, will be about five million bales. This added to the three million bales carry-over on August 1, 1948, will provide a total United States carry-over of eight million bales on August 1, 1949. Unless the acreage planted to cotton in 1949 is considerably less than the 1948 acreage, which is very doubtful, or unless yield per acre in 1949 is considerably below normal, the supply situation, as defined in the Agricultural Act of 1948, will be such that marketing quotas will be proclaimed for 1950.

Because of the minimum state, county and farm allotment provisions of the Agricultural Act of 1948, about 27 million acres is as small an acreage as can be allotted. Under the provisions of the Act the pattern of acreage allotments would be something like that of 1942, when the total allotment was about 27 million acres. During the 1938-42 period farmers planted an average of about 24 million acres and produced an average of about 12 million bales. This acreage is less than a million smaller than the 1948 acreage. However, the distribution of the acreage among the areas in 1948 is considerably different from the acreage allotment in 1942. In this respect the cotton production areas may be divided into three groups: (1) those showing a considerable increase in 1947 over 1942, (2) those showing only slight decreases between 1942 and

1947, and (3) those showing considerable decreases during this period (Table 6).

Among the areas showing considerable increase in cotton acreage and production since the outbreak of World War II are the High Plains cotton area of Texas, the Deltas, and the irrigated areas of California, Arizona, and New Mexico. Mechanization has advanced more rapidly in these than in other areas. Yields per acre have increased, and in general cotton has a high relative advantage over other crops. Areas showing a slight decrease in cotton acreage in recent years include the Blackland area of Texas and the Eastern Hilly areas of Mississippi, Alabama and Tennessee, and the Piedmont area. Areas in which considerable decreases have occurred include such areas as the Low Plains, where wheat has displaced considerable cotton, the Coastal Plains of the southeast, where peanut acreage has increased, and the Sandy Land area, where favorable off-farm employment opportunities have taken workers off the farms (Table 6).

TABLE 6. Distribution of Cotton Acreage Among Cotton Production Areas of the United States, 1937, 1942, and 1947

Cotton production area	Acreage of cotton[1]			1947 as per cent of	
	1937	1942	1947	1942	1937
	Million acres			*Per cent*	
High Plains	1.8	1.3	2.0	154	111
Irrigated	1.1	.8	1.0	125	91
Delta	4.6	3.3	3.7	112	80
Gulf Coast Prairies	1.3	.8	.9	112	69
Blacklands	4.3	2.8	2.7	96	63
Eastern Hilly	4.2	3.0	3.0	100	71
Texas Grazing	.8	.5	.5	100	62
Low Plains	3.6	2.7	2.3	85	64
Piedmont	2.5	1.7	1.4	82	56
Ozark-Ouachita Mountains and Valleys	1.0	.7	.5	71	50
Coastal Plains	4.8	3.1	2.2	71	46
Sandy Lands	3.0	1.8	.9	50	30
Cross Timbers	.6	.3	.15	50	25
Oklahoma Prairies	.5	.4	.16	40	32
Total United States	34.1	23.3	21.5	92	63

[1] In cultivation July 1.

Source: Work sneet used in 1948 Outlook Conference.

The acreage of cotton allotted to states, counties, and individual farms will depend on the basis used for making the distribution. If the same method used in 1938-42 is followed in 1950, the allotted acreage in the group of areas where considerable expansion in production has occurred probably would be about the same or possibly slightly larger than the acreage planted in 1947. The allotment in areas where there

TABLE 7. Cash Receipts from Cotton Lint and Cottonseed, and Comparisons, Louisiana, 1924-1948

Year	TOTAL	Cotton lint		Cottonseed		All other crops		Livestock and products	
	1,000 dollars	1,000 dollars	Pct. of total	1,000 dollars	Pct. of total	1,000 dollars	Pct. of total	1,000 dollars	Pct. of total
1924	121,484	50,444	41.5	5,240	4.3	44,290	36.5	21,510	17.7
1925	158,726	78,069	49.2	10,271	6.5	47,182	29.7	23,204	14.6
1926	134,607	57,445	42.7	6,729	5.0	45,259	33.6	25,174	18.7
1927	125,926	53,525	42.5	6,508	5.2	39,613	31.5	26,280	20.8
1928	136,291	55,211	40.5	7,988	5.9	47,276	34.7	25,816	18.9
1929	161,797	78,080	48.3	7,946	4.9	48,745	30.1	27,026	16.7
1930	108,238	36,820	34.0	5,114	4.7	41,911	38.7	24,393	22.6
1931	82,818	27,199	32.8	2,134	2.6	35,802	43.3	17,683	21.3
1932	61,288	18,108	29.5	2,192	3.6	27,075	44.2	13,913	22.7
1933	64,755	20,589	31.8	2,040	3.2	28,642	44.2	13,484	20.8
1934	88,323	36,763	41.6	5,767	6.5	30,342	34.4	15,451	17.5
1935	106,190	32,536	30.6	6,050	5.7	47,260	44.5	20,344	19.2
1936	129,043	46,163	35.9	9,817	7.6	52,199	40.5	20,864	16.1
1937	121,323	41,635	34.3	6,585	5.4	49,299	40.6	23,804	19.6
1938	107,221	31,021	28.9	4,813	4.5	46,707	43.6	24,680	23.0
1939	109,565	33,943	31.0	5,102	4.7	45,565	41.6	24,955	22.7
1940	92,857	24,962	26.9	3,106	3.3	38,696	41.7	26,093	28.1
1941	117,832	24,968	21.2	5,100	4.3	54,412	46.2	33,352	28.3
1942	183,719	46,946	25.6	9,476	5.2	83,541	45.4	43,756	23.8
1943	241,440	68,039	28.2	13,153	5.4	102,635	42.5	57,613	23.9
1944	234,816	68,350	29.1	10,226	4.4	95,844	40.8	60,396	25.7
1945	259,036	59,765	23.1	6,791	2.6	120,296	46.4	72,454	27.9
1946	255,457	36,712	14.3	5,048	2.0	130,972	51.3	82,725	32.4
1947	329,723	83,604	25.4	13,452	4.1	125,233	38.0	107,434	32.5
1948[1]	363,161	119,320	32.9	17,752	4.9	114,219	31.4	111,870	30.8

[1] Preliminary and partly estimated.

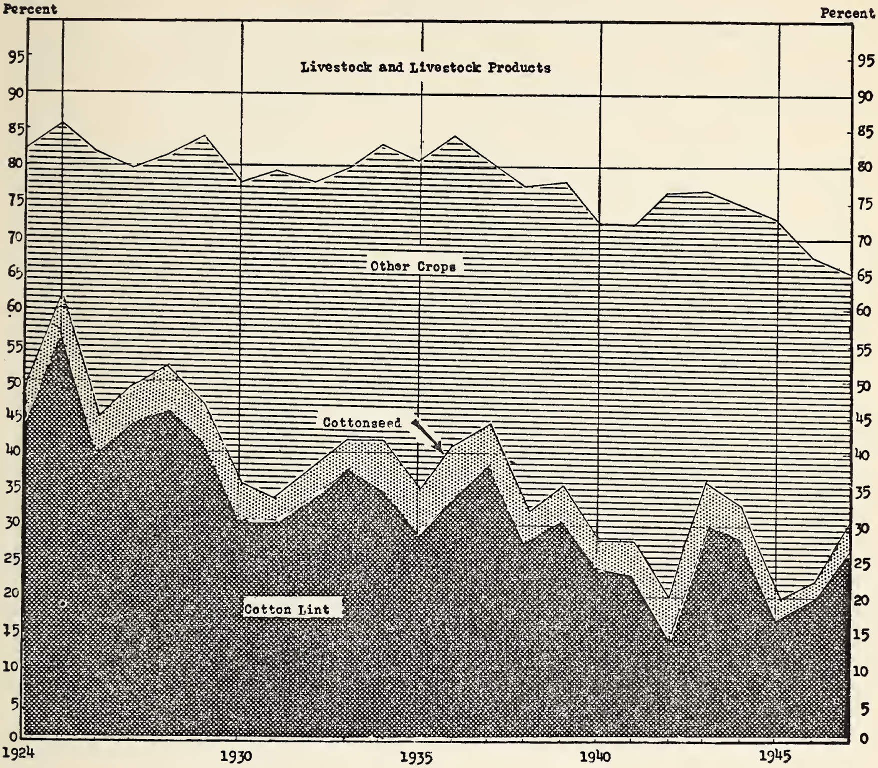
Source: Data on cash receipts were compiled from *Cash Receipts from Farming, 1924-44,* and from *Farm Income Situation Reports* for later years.

have been material decreases in plantings would be considerably above the acreage planted in 1947 or 1948.

It can be assumed that during the past few years, while acreage restrictions were not in force, farmers have tended to utilize their productive resources to best advantage. Where they have found it more profitable to produce other crops they have shifted from cotton. In areas where conditions were more favorable for cotton production than for other crops they have expanded their cotton acreage. Any program that will encourage expansion of acreage of cotton in areas of high cost per pound or bale production and force reduction in areas of lower production costs is economically unsound and subject to criticism.

Under existing law governing cotton acreage allotment, there will be considerable variation in the percentage of allowable acreage farmers will plant when the control program is put into effect. The acreage planted to cotton will depend to some extent upon alternative use op-

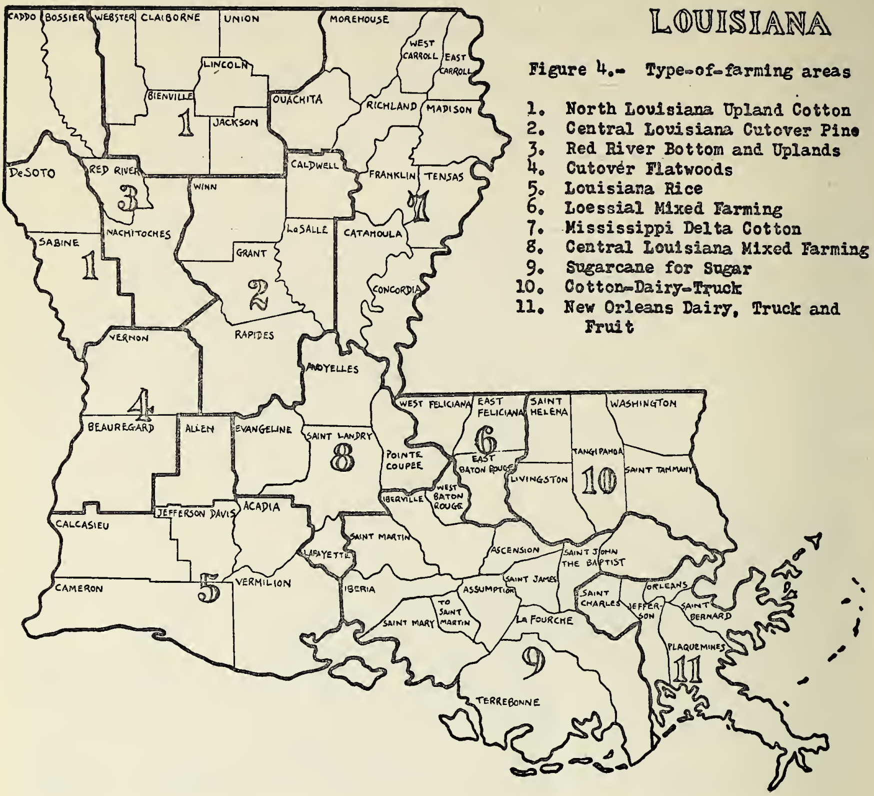
Figure 3. Percentages of Total Cash Receipts from Farm Marketings Received by Louisiana Farmers from Sales of Cotton, Cottonseed, other Crops, and Livestock and Livestock Products, 1924-1947



portunities for farmers' productive resources and upon the relative profitableness of cotton production and other employment opportunities including off-farm employment. As long as industrial expansion continues in the South, non-farm employment will increase, farm labor will be relatively scarce, and farm wage rates will continue high. All of these conditions and others may encourage further cotton acreage reduction, particularly in the high cost production areas.

Under these conditions mechanization of cotton probably would continue to advance and the most favorably situated areas would plant their full allotments. In other areas off-farm employment opportunities and alternative farm enterprises may become sufficiently profitable to cause further decrease in cotton acreage in the future.

Acreage allotments for other crops that farmers have substituted for cotton would tend to encourage farmers who have been growing these crops but have not been planting as much cotton as formerly, to



LOUISIANA

Figure 4.- Type-of-farming areas

1. North Louisiana Upland Cotton
2. Central Louisiana Cutover Pine
3. Red River Bottom and Uplands
4. Cutover Flatwoods
5. Louisiana Rice
6. Loessial Mixed Farming
7. Mississippi Delta Cotton
8. Central Louisiana Mixed Farming
9. Sugarcane for Sugar
10. Cotton-Dairy-Truck
11. New Orleans Dairy, Truck and Fruit

plant more closely to their cotton allotments. When control programs are reimposed there is likely to be a psychological reaction to increase cotton acreage with the idea of retaining eligibility and to obtain a larger allotment in future years. However, the prevailing price of cotton just prior to planting time will continue to be an important factor in determining cotton acreage until farmers and farm leaders learn more about the factors that determine what the price will be in the future.

TABLE 8. Cotton Lint: Acreage, Yield, and Production by Type-of-Farming Areas, Louisiana, 1928-1947

	1928			1929			1930		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville......	75,100	149	23,300	73,800	179	27,660	82,700	111	19,300
Claiborne.....	101,700	141	29,900	101,300	178	37,700	102,800	96	20,700
DeSoto.......	76,000	172	27,400	80,300	141	23,700	84,100	121	21,400
Jackson.......	21,200	188	8,320	24,700	195	10,100	21,800	133	6,050
Lincoln.......	65,200	154	21,000	65,200	195	26,600	68,400	89	12,700
Sabine........	38,000	148	11,800	38,900	137	11,100	37,500	129	10,200
Union........	54,400	148	16,900	56,700	191	22,600	63,000	98	13,000
Webster.......	58,300	157	19,100	60,700	171	21,700	64,200	92	12,300
Total.......	489,900	154	157,720	501,600	173	181,160	524,500	105	115,650
Area 2									
Caldwell......	11,800	197	4,880	13,100	266	7,290	15,200	177	5,630
Grant.........	16,300	189	6,450	14,900	200	6,230	12,400	192	4,990
LaSalle.......	3,000	150	940	2,300	233	1,120	2,500	178	930
Winn.........	18,700	164	6,440	19,400	166	6,750	17,700	139	5,130
Total.......	49,800	180	18,710	49,700	206	21,390	47,800	167	16,680
Area 3									
Bossier........	62,600	224	29,300	79,500	190	31,500	69,200	177	25,600
Caddo........	119,100	254	63,400	136,200	218	62,100	126,900	192	50,900
Natchitoches..	77,500	186	30,200	78,200	203	33,200	77,500	194	31,500
Rapides.......	43,300	150	13,600	42,300	237	20,900	46,000	279	26,900
Red River.....	46,900	214	20,900	52,600	182	20,000	57,800	155	18,700
Total.......	349,400	215	157,400	388,800	206	167,700	377,400	195	153,600
Area 4									
Beauregard....	6,200	214	2,780	7,300	162	2,480	8,000	232	3,880
Vernon.......	11,800	151	3,730	12,700	150	3,980	11,800	158	3,890
Total.......	18,000	173	6,510	20,000	154	6,460	19,800	188	7,770
Area 5									
E. Baton Rouge	14,400	132	3,980	12,100	129	3,270	11,400	177	4,220
E. Feliciana...	21,500	104	4,670	22,900	115	5,520	21,700	180	8,160
W. Feliciana...	6,900	112	1,620	11,200	109	2,550	9,700	203	4,130
Total.......	42,800	115	10,270	46,200	117	11,340	42,800	184	16,510
Area 6									
Catahoula.....	26,200	172	9,450	21,700	250	11,400	26,200	220	12,060
Concordia.....	20,600	177	7,640	17,000	280	9,970	21,800	309	14,100
E. Carroll.....	42,800	262	23,400	44,800	340	31,800	47,000	223	21,900
Franklin......	93,900	182	35,800	92,500	258	50,000	99,000	147	30,300
Madison......	27,700	220	12,700	33,600	299	21,000	40,500	205	17,400
Morehouse....	54,400	179	20,400	62,000	227	29,400	58,100	154	18,700
Ouachita......	32,400	200	13,500	38,200	241	19,200	33,100	158	10,900
Richland......	83,500	190	33,200	75,500	262	41,400	80,300	146	24,600
Tensas........	34,600	191	13,800	44,700	239	22,300	45,000	254	23,900
W. Carroll....	37,200	212	16,500	37,500	283	22,200	39,300	151	12,400
Total.......	453,300	197	186,390	467,500	264	258,670	490,300	182	186,260

(*Continued*)

TABLE 8—(continued)

	1928			1929			1930		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	58,800	156	19,200	56,300	196	23,100	57,000	232	27,700
Evangeline	53,600	150	16,900	51,800	180	19,500	57,900	195	23,600
Lafayette	53,300	179	19,960	53,000	168	18,700	53,000	200	22,200
Pointe Coupee	20,400	133	5,680	22,800	168	8,010	26,400	282	15,600
St. Landry	94,300	135	26,600	93,750	161	31,500	95,300	238	47,500
Total	280,400	151	88,340	277,650	174	100,810	289,600	225	136,600
Area 8									
Ascension	...	...	...	...	...	...	...	...	...
Assumption	...	...	...	...	...	...	...	...	...
Iberia	...	...	...	...	...	...	...	...	...
Iberville	...	...	...	...	...	...	...	...	...
Lafourche	...	...	...	...	...	...	...	...	...
St. James	...	...	...	...	...	...	...	...	...
St. John	...	...	...	...	...	...	...	...	...
St. Martin	16,500	134	4,620	13,600	123	3,490	15,500	247	8,020
St. Mary	...	...	...	...	...	...	...	...	...
Terrebonne	...	...	...	...	...	...	...	...	...
W.Baton Rouge	...	...	...	...	...	...	...	...	...
Total	16,500	134	4,620	13,600	123	3,490	15,500	247	8,020
Area 9									
Livingston	...	...	...	...	...	...	...	...	...
St. Helena	...	...	...	...	...	...	...	...	...
St. Tammany	...	...	...	...	...	...	...	...	...
Tangipahoa	...	...	...	...	...	...	...	...	...
Washington	28,400	121	7,200	28,100	137	8,070	29,400	216	13,300
Total	28,400	121	7,200	28,100	137	8,070	29,400	216	13,300
Area 10									
Jefferson	...	...	...	...	...	...	...	...	...
Orleans	...	...	...	...	...	...	...	...	...
Plaquemines	...	...	...	...	...	...	...	...	...
St. Bernard	...	...	...	...	...	...	...	...	...
St. Charles	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...
Area 11									
Acadia	42,300	208	18,400	47,100	160	15,700	42,300	210	18,500
Allen	...	...	...	...	...	...	...	...	...
Calcasieu	...	...	...	...	...	...	...	...	...
Cameron	7,200	202	3,050	9,100	135	2,580	7,700	201	3,230
Jeff. Davis	12,200	196	5,010	12,100	162	4,090	11,400	229	5,450
Vermilion	34,100	155	11,100	41,200	128	11,000	36,400	172	13,110
Total	95,800	187	37,560	109,500	146	33,370	97,800	197	40,290
ALL OTHER	48,700	160	16,280	51,350	154	16,540	48,100	202	20,320
STATE	1,873,000	176	691,000	1,954,000	198	809,000	1,983,000	172	715,000

(*Continued*)

TABLE 8—(continued)

	1931			1932			1933[1]		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville......	75,200	163	25,600	68,700	125	18,000	67,400	146	14,500
Claiborne.....	93,200	177	34,500	86,800	126	22,800	84,900	138	17,100
DeSoto.......	79,700	146	24,300	77,500	97	15,700	66,400	125	11,700
Jackson.......	19,200	215	8,610	18,700	165	6,470	24,500	115	4,310
Lincoln.......	62,100	180	23,300	60,000	148	18,500	63,600	122	11,400
Sabine........	33,600	169	11,900	31,600	130	8,590	32,900	141	7,020
Union........	56,600	177	20,900	53,400	146	16,300	59,000	143	12,800
Webster.......	63,200	189	24,900	59,300	126	15,700	58,400	142	13,000
Total.......	482,800	172	174,010	456,000	128	122,060	457,100	...	91,830
Area 2									
Caldwell......	14,200	245	7,270	13,200	219	6,050	16,500	170	4,130
Grant........	11,900	290	7,200	11,500	169	4,060	13,500	204	3,880
LaSalle.......	2,500	234	1,220	2,200	160	740	2,900	234	1,070
Winn.........	16,700	202	7,060	16,300	160	5,470	17,000	148	3,720
Total.......	45,300	240	22,750	43,200	181	16,320	49,900	...	12,800
Area 3									
Bossier........	66,100	295	40,800	54,800	218	25,000	68,700	161	17,900
Caddo........	123,700	282	73,000	107,200	203	45,600	118,800	146	28,100
Natchitoches...	75,500	281	44,300	73,500	199	30,500	73,500	164	19,000
Rapides.......	45,000	313	29,500	39,100	222	18,100	41,800	223	14,400
Red River.....	54,700	217	24,800	51,600	173	18,700	53,000	142	12,100
Total.......	365,000	278	212,400	326,200	202	137,900	355,800	...	91,500
Area 4									
Beauregard....	5,300	216	2,390	4,500	184	1,730	7,500	123	1,480
Vernon.......	8,200	141	2,420	8,200	149	2,550	13,200	156	2,810
Total.......	13,500	170	4,810	12,700	161	4,280	20,700	..	4,290
Area 5									
E. Baton Rouge	8,200	180	3,080	6,600	111	1,530	7,000	172	2,040
E. Feliciana...	21,500	187	8,380	21,100	121	5,380	20,500	160	5,390
W. Feliciana...	7,900	214	3,530	6,500	135	1,840	6,400	116	1,080
Total.......	37,600	191	14,990	34,200	122	8,750	33,900	...	8,510
Area 6									
Catahoula.....	25,100	266	14,000	23,900	180	9,020	22,800	238	8,080
Concordia.....	24,100	295	14,900	26,400	202	11,200	23,700	220	7,870
E. Carroll.....	43,000	369	33,100	42,400	240	21,200	43,200	300	20,500
Franklin......	94,900	288	57,100	94,900	222	44,100	94,400	183	28,600
Madison......	35,100	300	22,000	35,100	225	16,500	31,800	209	10,200
Morehouse....	55,400	230	26,700	54,500	194	22,050	58,400	169	15,400
Ouachita......	31,200	252	16,400	29,400	208	12,800	35,000	179	9,820
Richland......	77,200	240	38,700	77,200	188	30,400	73,700	182	20,500
Tensas........	36,800	341	26,300	37,800	235	18,600	40,100	205	13,100
W. Carroll.....	38,300	296	23,700	39,300	215	17,700	37,200	248	14,700
Total.......	461,100	283	272,900	460,900	211	203,570	460,300	...	148,770

(*Continued*)

TABLE 8—(continued)

	1931			1932			1933[1]		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	53,000	290	32,100	49,200	166	17,100	48,400	213	16,500
Evangeline	55,700	177	20,500	54,400	152	17,300	47,600	169	12,300
Lafayette	49,200	212	21,800	38,470	152	12,200	39,280	202	12,200
Pointe Coupee	24,400	275	14,000	20,300	158	6,720	19,800	208	6,950
St. Landry	88,300	223	41,100	82,300	149	25,700	80,600	199	25,600
Total	270,600	229	129,500	244,670	154	79,020	235,680	...	73,550
Area 8									
Ascension	....	.....	....	....	.....	....	....	.....	....
Assumption	....	.....	....	....	.....	....	....	.....	....
Iberia	....	.....	....	....	.....	....	....	.....	....
Iberville	....	.....	....	....	.....	....	....	.....	....
Lafourche	....	.....	....	....	.....	....	....	.....	....
St. James	....	.....	....	....	.....	....	....	.....	....
St. John	....	.....	....	....	.....	....	....	.....	....
St. Martin	14,300	203	6,070	9,600	138	2,770	13,120	186	3,730
St. Mary	....	.....	....	....	.....	....	....	.....	....
Terrebonne	....	.....	....	....	.....	....	....	.....	....
W.Baton Rouge	....	.....	....	....	.....	....	....	.....	....
Total	14,300	203	6,070	9,600	138	2,770	13,120	.....	3,730
Area 9									
Livingston	....	.....	....	....	.....	....	....	.....	....
St. Helena	....	.....	....	....	.....	....	....	.....	....
St. Tammany	....	.....	....	....	.....	....	....	.....	....
Tangipahoa	....	.....	....	....	.....	....	....	.....	....
Washington	31,500	191	12,600	27,800	123	7,360	32,000	175	9,230
Total	31,500	191	12,600	27,800	123	7,360	32,000	.....	9,230
Area 10									
Jefferson	....	.....	....	....	.....	....	....	.....	....
Orleans	....	.....	....	....	.....	....	....	.....	....
Plaquemines	....	.....	....	....	.....	....	....	.....	....
St. Bernard	....	.....	....	....	.....	....	....	.....	....
St. Charles	....	.....	....	....	.....	....	....	.....	....
Total	....	.....	....	....	.....	....	....	.....	....
Area 11									
Acadia	31,700	229	15,200	27,200	187	10,600	33,200	202	10,300
Allen	....	.....	....	....	.....	....	....	.....	....
Calcasieu	....	.....	....	....	.....	....	....	.....	....
Cameron	7,700	253	4,070	6,100	228	2,910	6,200	263	2,590
Jeff. Davis	10,500	202	4,420	10,700	172	3,860	11,400	196	3,640
Vermilion	26,500	207	11,500	17,500	143	5,230	21,700	198	6,920
Total	76,400	220	35,190	61,500	176	22,600	72,500	.....	23,450
ALL OTHER	35,900	197	14,780	25,230	120	6,370	36,000	169	9,340
STATE	1,834,000	235	900,000	1,702,000	172	611,000	1,767,000	174	477,000

[1] Average yields per acre for areas are not given because acreages given are acres planted and no data are given for acres removed in the 1933 reduction program.

TABLE 8—(continued)

	1934			1935			1936		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville......	44,700	123	11,500	48,100	144	14,500	50,700	149	15,700
Claiborne.....	56,000	131	15,300	60,300	140	17,600	69,700	142	20,700
DeSoto.......	46,700	121	11,800	53,800	132	14,800	53,400	151	16,800
Jackson.......	14,100	167	4,920	14,900	147	4,570	16,000	128	4,270
Lincoln.......	36,800	157	12,100	41,900	144	12,600	44,400	164	15,300
Sabine........	22,300	156	7,270	25,000	142	7,430	25,100	124	6,500
Union........	34,600	143	10,400	38,400	126	10,100	40,500	162	13,700
Webster.......	38,000	116	9,260	40,200	142	11,900	48,100	120	12,100
Total.......	293,200	135	82,550	322,600	139	93,500	347,900	144	105,070
Area 2									
Caldwell......	9,800	274	5,630	10,800	247	5,570	11,400	230	5,480
Grant.........	10,500	276	6,070	9,400	127	2,500	12,000	195	4,890
LaSalle.......	2,700	182	1,030	2,300	173	830	1,900	207	820
Winn.........	10,500	177	3,900	12,100	135	3,420	11,000	149	3,410
Total.......	33,500	237	16,630	34,600	170	12,320	36,300	192	14,600
Area 3									
Bossier........	45,600	209	19,900	48,400	245	24,800	54,900	308	35,300
Caddo........	77,400	210	34,000	86,300	249	44,900	98,000	263	53,900
Natchitoches...	52,400	263	28,800	54,800	182	20,800	63,100	221	29,200
Rapides.......	31,400	288	18,900	30,700	226	14,500	34,000	387	27,500
Red River.....	35,300	198	14,600	35,200	166	12,200	39,300	237	19,500
Total.......	242,100	229	116,200	255,400	219	117,200	289,300	273	165,400
Area 4									
Beauregard....	4,100	196	1,670	4,400	138	1,260	2,900	185	1,130
Vernon.......	9,000	175	3,300	10,400	107	2,320	8,500	137	2,440
Total.......	13,100	181	4,970	14,800	116	3,580	11,400	150	3,570
Area 5									
E. Baton Rouge	6,300	103	1,370	7,000	196	2,870	7,700	188	3,050
E. Feliciana...	14,000	74	2,160	13,900	194	5,630	15,100	300	9,470
W. Feliciana...	5,500	62	720	5,100	150	1,600	5,700	178	2,120
Total.......	25,800	79	4,250	26,000	186	10,100	28,500	246	14,640
Area 6									
Catahoula.....	16,400	255	8,740	16,400	250	8,550	20,300	328	13,900
Concordia.....	16,500	235	8,110	14,900	295	9,180	18,200	481	18,300
E. Carroll.....	30,700	294	18,850	31,200	352	22,900	36,300	505	38,200
Franklin......	59,000	252	31,100	65,500	235	32,200	73,500	277	42,500
Madison......	21,700	252	11,400	23,800	252	12,500	26,400	453	25,000
Morehouse....	37,100	257	19,900	41,900	215	18,800	45,500	285	27,100
Ouachita......	22,800	247	11,800	25,000	239	12,500	26,600	277	15,400
Richland......	49,800	226	23,600	57,100	222	26,500	60,700	246	31,200
Tensas........	25,600	262	14,000	58,500	309	18,400	32,500	476	32,300
W. Carroll....	25,700	227	12,200	27,700	222	12,800	29,400	336	20,600
Total.......	305,300	250	159,700	362,000	230	174,330	369,400	342	264,500

(*Continued*)

TABLE 8—(continued)

	1934			1935			1936		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	37,100	212	16,500	34,600	226	16,300	40,800	366	31,200
Evangeline	35,000	188	13,800	33,900	257	18,200	37,800	227	17,900
Lafayette	30,110	128	8,040	30,820	253	16,300	35,400	284	21,000
Pointe Coupee	15,500	156	5,050	16,000	248	8,300	18,500	412	15,900
St. Landry	59,500	170	21,200	59,300	248	30,700	64,300	306	41,000
Total	177,210	174	64,590	174,620	246	89,800	196,800	308	127,000
Area 8									
Ascension	....	.....	....	....	.....	....	....	.....	....
Assumption	....	.....	....	....	.....	....	....	.....	....
Iberia	....	.....	....	....	.....	....	....	.....	....
Iberville	....	.....	....	....	.....	....	....	.....	....
Lafourche	....	.....	....	....	.....	....	....	.....	....
St. James	....	.....	....	....	.....	....	....	.....	....
St. John	....	.....	....	....	.....	....	....	.....	....
St. Martin	10,250	46	980	8,530	233	4,160	11,480	275	6,600
St. Mary	....	.....	....	....	.....	....	....	.....	....
Terrebonne	....	.....	....	....	.....	....	....	.....	....
W. Baton Rouge	....	.....	....	....	.....	....	....	.....	....
Total	10,250	46	980	8,530	233	4,160	11,480	275	6,600
Area 9									
Livingston	....	.....	....	....	.....	....	....	.....	....
St. Helena	....	.....	....	....	.....	....	....	.....	....
St. Tammany	....	.....	....	....	.....	....	....	.....	....
Tangipahoa	....	.....	....	....	.....	....	....	.....	....
Washington	21,500	163	7,340	21,100	252	11,100	23,200	269	13,100
Total	21,500	163	7,340	21,100	252	11,100	23,200	269	13,100
Area 10									
Jefferson	....	.....	....	....	.....	....	....	.....	....
Orleans	....	.....	....	....	.....	....	....	.....	....
Plaquemines	....	.....	....	....	.....	....	....	.....	....
St. Bernard	....	.....	....	....	.....	....	....	.....	....
St. Charles	....	.....	....	....	.....	....	....	.....	....
Total	....	.....	....	....	.....	....	....	.....	....
Area 11									
Acadia	25,000	206	10,700	27,400	251	14,400	29,000	264	16,000
Allen	....	.....	....	....	.....	....	....	.....	....
Calcasieu	....	.....	....	....	.....	....	....	.....	....
Cameron	5,300	232	2,590	5,400	206	2,330	5,900	181	2,230
Jeff. Davis	7,300	197	3,010	8,100	234	3,960	8,200	290	4,990
Vermilion	17,500	124	4,530	18,900	222	8,770	21,600	218	9,850
Total	55,100	181	20,830	59,800	235	29,460	64,700	244	33,070
ALL OTHER	23,940	139	6,960	28,550	175	10,450	30,020	215	13,450
STATE	1,201,000	193	485,000	1,308,000	203	556,000	1,409,000	259	761,000

(*Continued*)

TABLE 8—(continued)

	1937			1938			1939		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville	51,000	231	24,600	38,400	189	15,100	40,380	213	17,510
Claiborne	72,000	216	32,500	52,700	191	20,300	52,570	217	23,300
DeSoto	60,800	211	26,800	44,900	200	18,700	47,474	253	24,006
Jackson	16,000	205	6,850	11,740	204	4,980	12,100	217	5,360
Lincoln	50,000	220	23,000	35,450	213	15,700	35,600	216	15,700
Sabine	25,100	210	11,000	18,700	182	7,030	18,300	231	8,650
Union	43,000	215	19,300	31,900	217	14,400	33,150	238	16,200
Webster	45,800	236	22,600	32,300	197	13,100	31,900	216	14,200
Total	363,700	219	166,650	266,090	196	109,310	271,474	220	124,926
Area 2									
Caldwell	13,800	300	8,640	9,200	281	5,330	9,450	318	6,130
Grant	12,700	261	6,900	7,800	253	4,100	8,100	314	5,210
LaSalle	3,400	296	2,100	2,400	217	1,060	2,340	261	1,250
Winn	12,000	224	5,610	9,030	228	4,290	9,250	211	4,022
Total	41,900	265	23,250	28,430	248	14,780	29,140	272	16,612
Area 3									
Bossier	61,000	348	44,300	41,500	263	22,300	41,700	345	29,100
Caddo	103,000	362	77,800	69,600	298	42,800	65,916	379	51,405
Natchitoches	66,600	301	41,900	47,000	302	29,290	47,800	319	31,300
Rapides	36,400	427	32,500	25,900	309	16,500	26,800	398	22,100
Red River	44,100	344	31,700	32,100	241	15,800	31,560	282	18,313
Total	311,100	351	228,200	216,100	280	126,690	213,776	340	152,218
Area 4									
Beauregard	3,200	228	1,520	2,620	231	1,160	2,000	253	1,042
Vernon	11,000	214	4,900	7,300	202	3,000	6,860	235	3,330
Total	14,200	216	6,420	9,920	200	4,160	8,860	236	4,372
Area 5									
E. Baton Rouge	9,800	262	5,360	6,160	184	2,364	5,050	118	1,230
E. Feliciana	17,400	279	10,100	13,700	224	6,360	13,000	141	3,800
W. Feliciana	8,500	267	4,740	5,800	164	1,950	5,300	162	1,771
Total	35,700	270	20,200	25,660	199	10,674	23,350	139	6,801
Area 6									
Catahoula	24,000	389	19,400	16,850	297	10,420	17,600	353	12,400
Concordia	23,500	454	22,300	16,500	286	9,800	16,200	347	11,500
E. Carroll	46,500	516	50,100	32,550	391	26,300	33,211	413	27,902
Franklin	77,000	372	59,800	56,700	349	40,800	58,300	344	41,300
Madison	33,000	469	32,300	25,100	414	21,500	26,650	410	22,446
Morehouse	52,000	388	42,100	37,500	337	26,200	38,800	408	32,600
Ouachita	32,100	335	22,500	22,800	287	13,400	22,900	299	14,030
Richland	68,300	420	59,900	52,900	339	37,500	54,170	329	36,503
Tensas	38,200	500	39,900	28,550	340	19,900	28,919	408	24,009
W. Carroll	42,500	409	36,300	30,100	318	19,900	30,700	393	24,900
Total	437,100	421	384,600	319,550	338	225,720	327,450	361	247,590

(Continued)

TABLE 8—(continued)

	1937			1938			1939		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	42,000	429	37,600	31,420	351	22,900	33,800	400	27,200
Evangeline	38,300	348	27,800	29,200	326	19,800	30,200	401	25,000
Lafayette	36,500	349	26,600	28,640	332	19,800	29,940	322	19,840
Pointe Coupee	23,100	448	21,600	15,800	365	12,000	15,800	309	10,110
St. Landry	69,000	418	60,200	54,000	343	38,600	55,000	363	41,400
Total	208,900	398	173,800	159,060	340	113,100	164,740	358	123,550
Area 8									
Ascension									
Assumption									
Iberia									
Iberville									
Lafourche									
St. James									
St. John									
St. Martin	13,500	332	9,360	9,630	385	7,720	10,900	310	6,586
St. Mary									
Terrebonne									
W.Baton Rouge									
Total	13,500	332	9,360	9,630	385	7,720	10,900	310	6,586
Area 9									
Livingston									
St. Helena									
St. Tammany									
Tangipahoa				7,170	251	3,750	7,150	212	3,043
Washington	29,900	315	19,700	20,400	291	12,220	20,570	238	10,000
Total	29,900	315	19,700	27,570	277	15,970	27,720	225	13,043
Area 10									
Jefferson									
Orleans									
Plaquemines									
St. Bernard									
St. Charles									
Total									
Area 11									
Acadia	31,700	341	22,600	24,130	373	18,560	25,100	414	21,400
Allen				4,070	260	2,130	3,970	289	2,380
Calcasieu				4,430	236	2,130	3,780	217	1,689
Cameron	5,900	197	2,430	4,270	249	2,166	3,775	268	2,084
Jeff. Davis	10,400	352	7,640	7,340	272	4,150	6,590	306	4,170
Vermilion	23,600	282	13,900	18,950	317	11,800	18,560	325	12,280
Total	71,600	311	46,570	63,190	310	40,936	61,775	340	44,003
ALL OTHER	47,400	255	25,250	14,800	228	6,940	14,815	175	5,299
STATE	1,575,000	336	1,104,000	1,140,000	287	676,000	1,154,000	315	745,000

(*Continued*)

TABLE 8—(continued)

	1940			1941			1942		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville......	42,700	137	11,660	34,800	55	3,900	29,000	169	10,140
Claiborne.....	53,100	188	20,480	51,100	77	7,980	43,700	179	16,120
DeSoto.......	47,500	226	21,610	43,200	30	2,580	39,700	163	13,250
Jackson.......	11,400	142	3,305	9,400	84	1,610	8,200	154	2,590
Lincoln.......	38,500	129	9,690	32,700	95	6,380	29,200	184	11,120
Sabine........	19,700	186	7,435	15,300	43	1,350	13,500	174	4,860
Union........	34,200	171	11,900	30,100	107	6,641	28,200	236	13,790
Webster.......	35,800	191	13,540	31,600	87	5,650	25,700	174	9,180
Total.......	282,900	168	99,620	248,200	70	36,091	217,200	178	81,050
Area 2									
Caldwell......	9,900	240	4,840	9,100	158	2,890	8,100	303	4,980
Grant.........	8,600	162	2,790	6,500	72	951	6,800	218	2,810
LaSalle.......	....	......	....	....	......	....	....	......	....
Winn.........	9,400	122	2,315	6,900	58	823	6,100	158	2,000
Total.......	27,900	170	9,945	22,500	99	4,664	21,000	223	9,790
Area 3									
Bossier........	43,400	259	22,570	40,300	97	7,970	40,000	203	16,650
Caddo........	74,100	296	42,780	67,200	119	16,030	62,500	258	33,150
Natchitoches...	49,250	244	24,370	44,000	59	5,380	41,800	283	24,200
Rapides.......	27,150	163	9,050	19,600	96	3,880	19,100	334	13,080
Red River.....	33,400	207	13,800	30,000	41	2,490	26,800	188	10,340
Total.......	227,300	237	112,570	201,100	85	35,750	190,200	245	97,420
Area 4									
Beauregard....	....	......	....	....	......	....	....	......	....
Vernon.......	....	......	....	....	......	....	3,000	197	1,220
Total.......	....	......	....	....	......	....	3,000	197	1,220
Area 5									
E. Baton Rouge	....	......	....	....	......	....	....	......	....
E. Feliciana...	12,700	127	3,275	11,400	133	3,130	11,700	200	4,810
W. Feliciana...	5,560	63	690	4,100	109	930	4,900	221	2,220
Total.......	18,260	104	3,965	15,500	125	4,060	16,600	202	7,030
Area 6									
Catahoula.....	18,200	176	6,410	15,900	136	4,440	15,400	396	12,510
Concordia.....	17,850	148	5,060	16,300	164	5,400	15,700	457	14,540
E. Carroll.....	34,200	225	15,690	33,400	291	19,751	33,100	423	28,750
Franklin......	61,400	295	36,390	59,600	171	20,820	58,200	385	46,050
Madison......	28,200	177	9,990	26,500	238	12,842	26,600	430	23,520
Morehouse....	39,900	213	17,320	38,300	247	19,450	36,900	412	31,420
Ouachita......	22,900	202	9,300	20,800	180	7,660	19,700	307	12,320
Richland......	53,700	211	23,260	51,600	243	25,821	51,600	332	35,180
Tensas........	29,800	246	15,130	30,000	197	12,069	28,500	441	25,840
W. Carroll....	33,200	205	13,850	32,300	272	17,770	30,600	340	21,320
Total.......	339,350	215	152,400	324,700	215	146,023	316,300	380	251,450

(Continued)

TABLE 8—(continued)

	1940			1941			1942		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	34,400	166	11,630	30,200	158	9,750	29,500	395	23,960
Evangeline	31,900	129	8,470	28,200	161	9,430	27,200	293	16,370
Lafayette	29,600	112	6,895	26,490	185	10,150	26,800	201	11,100
Pointe Coupee	16,500	156	5,200	14,400	167	4,940	15,300	368	11,670
St. Landry	55,900	116	13,560	52,900	167	18,240	54,300	278	31,140
Total	168,300	130	45,755	152,190	165	52,510	153,100	294	94,240
Area 8									
Ascension	...	...	...	...	...	...	...	...	...
Assumption	...	...	...	...	...	...	...	...	...
Iberia	...	...	...	...	...	...	...	...	...
Iberville	...	...	...	...	...	...	...	...	...
Lafourche	...	...	...	...	...	...	...	...	...
St. James	...	...	...	...	...	...	...	...	...
St. John	...	...	...	...	...	...	...	...	...
St. Martin	10,790	145	3,225	10,020	136	2,820	12,500	186	4,770
St. Mary	...	...	...	...	...	...	...	...	...
Terrebonne	...	...	...	...	...	...	...	...	...
W.Baton Rouge	...	...	...	...	...	...	...	...	...
Total	10,790	145	3,225	10,020	136	2,820	12,500	186	4,770
Area 9									
Livingston	...	...	...	...	...	...	...	...	...
St. Helena	...	...	...	...	...	...	...	...	...
St. Tammany	...	...	...	...	...	...	...	...	...
Tangipahoa	...	...	...	...	...	...	...	...	...
Washington	20,200	200	8,370	18,100	186	6,930	18,900	258	10,070
Total	20,200	200	8,370	18,100	186	6,930	18,900	258	10,070
Area 10									
Jefferson	...	...	...	...	...	...	...	...	...
Orleans	...	...	...	...	...	...	...	...	...
Plaquemines	...	...	...	...	...	...	...	...	...
St. Bernard	...	...	...	...	...	...	...	...	...
St. Charles	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...
Area 11									
Acadia	26,900	91	4,880	23,400	189	9,080	22,700	275	12,830
Allen	4,260	116	1,000	3,000	69	421	2,600	236	1,270
Calcasieu	...	...	...	...	...	...	...	...	...
Cameron	...	...	...	...	...	...	...	...	...
Jeff. Davis	7,020	75	1,080	5,100	93	990	4,900	228	2,310
Vermilion	18,400	52	1,980	15,800	148	4,870	15,600	216	6,970
Total	56,580	76	8,940	47,300	155	15,361	45,800	244	23,380
ALL OTHER	47,420	113	11,210	31,390	134	8,791	33,400	184	12,580
STATE	1,199,000	188	456,000	1,071,000	143	313,000	1,028,000	281	593,000

(*Continued*)

TABLE 8—(continued)

	1943			1944			1945		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 1									
Bienville......	28,400	217	12,800	23,200	137	6,600	17,000	68	2,400
Claiborne.....	42,270	197	17,300	36,600	151	11,500	27,300	135	7,650
DeSoto.......	38,550	229	18,300	30,700	158	10,100	24,800	107	5,500
Jackson.......	6,950	214	3,090	5,400	205	2,300	4,700	97	950
Lincoln.......	26,850	201	11,200	24,300	170	8,600	19,300	96	3,840
Sabine........	10,810	274	6,150	7,150	176	2,610	5,250	158	1,720
Union........	28,200	241	14,100	21,700	214	9,650	19,300	143	5,750
Webster.......	24,800	204	10,500	19,700	172	7,050	18,200	126	4,750
Total.......	206,830	216	93,440	168,750	165	58,410	138,850	115	32,560
Area 2									
Caldwell......	7,880	428	7,000	7,150	418	6,200	8,650	179	3,210
Grant.........	5,570	375	4,340	5,400	486	5,450	6,200	202	2,600
LaSalle.......	....	.....	....	....	.....	....	....	.....	....
Winn.........	5,400	247	2,770	4,240	249	2,190	3,500	127	920
Total.......	18,850	358	14,110	16,790	394	13,840	18,350	175	6,730
Area 3									
Bossier........	35,850	313	23,300	32,800	258	17,600	30,900	162	10,400
Caddo........	63,450	364	48,000	54,900	288	32,800	59,300	231	28,400
Natchitoches..	41,600	397	34,300	37,050	446	34,300	37,500	241	18,800
Rapides.......	19,240	468	18,700	17,450	466	16,900	15,600	304	9,850
Red River.....	25,150	291	15,200	26,600	243	13,400	23,500	140	6,850
Total.......	185,290	360	139,500	168,800	326	115,000	166,800	213	74,300
Area 4									
Beauregard....	....	.....	....	....	.....	....	....	.....	....
Vernon.......	2,250	267	1,250	....	.....	....	....	.....	....
Total.......	2,250	267	1,250	....	.....	....	....	.....	....
Area 5									
E. Baton Rouge	....	.....	....	....	.....	....	....	.....	....
E. Feliciana...	10,800	261	5,850	10,600	286	6,300	8,900	143	2,640
W. Feliciana...	4,000	256	2,130	....	.....	....	....	.....	....
Total.......	14,800	258	7,980	10,600	286	6,300	8,900	143	2,640
Area 6									
Catahoula.....	15,840	465	15,300	11,950	419	10,400	12,400	161	4,140
Concordia.....	15,900	457	15,100	13,000	482	13,000	12,100	207	5,200
E. Carroll.....	34,450	474	33,900	34,400	459	32,800	32,800	225	15,300
Franklin......	58,750	378	46,100	55,900	333	38,700	53,600	253	28,200
Madison......	26,300	478	26,100	23,300	482	23,300	23,800	229	11,300
Morehouse....	37,000	424	32,600	32,100	425	28,300	30,600	385	24,500
Ouachita......	18,800	379	14,800	18,200	408	15,400	17,500	212	7,700
Richland......	51,800	416	44,800	49,800	367	37,900	47,600	287	28,400
Tensas........	28,500	468	27,700	26,500	453	24,900	25,800	293	15,700
W. Carroll....	30,850	350	22,400	28,900	355	21,300	26,400	284	15,600
Total.......	318,190	419	278,800	294,050	400	246,000	282,600	264	156,040

(Continued)

TABLE 8—(continued)

	1943			1944			1945		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*		*Lbs.*	*Bales*
Area 7									
Avoyelles	31,100	458	29,600	29,400	449	27,400	27,300	273	15,500
Evangeline	26,900	390	21,800	24,630	358	18,300	22,860	322	15,300
Lafayette	24,900	425	22,000	24,700	372	19,100	23,500	303	14,800
Pointe Coupee	14,500	455	13,700	14,300	438	13,000	12,100	278	7,000
St. Landry	53,550	440	48,900	53,100	409	45,100	48,100	254	25,400
Total	150,950	431	136,000	146,130	402	122,900	133,860	279	78,000
Area 8									
Ascension	...	...	...	...	...	...	...	...	...
Assumption	...	...	...	...	...	...	...	...	...
Iberia	...	...	...	...	...	...	...	...	...
Iberville	...	...	...	...	...	...	...	...	...
Lafourche	...	...	...	...	...	...	...	...	...
St. James	...	...	...	...	...	...	...	...	...
St. John	...	...	...	...	...	...	...	...	...
St. Martin	9,630	442	8,850	11,000	387	8,850	8,750	333	6,050
St. Mary	...	...	...	...	...	...	...	...	...
Terrebonne	...	...	...	...	...	...	...	...	...
W.Baton Rouge	...	...	...	...	...	...	...	...	...
Total	9,630	442	8,850	11,000	387	8,850	8,750	333	6,050
Area 9									
Livingston	...	...	...	...	...	...	...	...	...
St. Helena	...	...	...	...	...	...	...	...	...
St. Tammany	...	...	...	...	...	...	...	...	...
Tangipahoa	...	...	...	...	...	...	...	...	...
Washington	15,820	313	10,300	14,900	283	8,750	12,400	196	5,050
Total	15,820	313	10,300	14,900	283	8,750	12,400	196	5,050
Area 10									
Jefferson	...	...	...	...	...	...	...	...	...
Orleans	...	...	...	...	...	...	...	...	...
Plaquemines	...	...	...	...	...	...	...	...	...
St. Bernard	...	...	...	...	...	...	...	...	...
St. Charles	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...
Area 11									
Acadia	20,550	464	19,800	20,500	376	16,000	20,300	292	12,300
Allen	2,100	335	1,460	...	...	...	...	...	...
Calcasieu	...	...	...	...	...	...	...	...	...
Cameron	...	...	...	...	...	...	...	...	...
Jeff. Davis	3,600	300	2,240	...	...	...	...	...	...
Vermilion	12,650	381	10,000	12,610	342	8,950	13,100	211	5,750
Total	38,900	412	33,500	33,110	360	24,950	33,400	258	18,050
ALL OTHER	25,490	288	15,270	26,870	269	15,000	18,090	202	7,580
STATE	987,000	360	739,000	891,000	335	620,000	819,000	227	387,000

(*Continued*)

TABLE 8—(continued)

	1946			1947		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*
Area 1						
Bienville	14,400	68	2,030	13,100	148	4,050
Claiborne	29,900	112	7,000	30,300	129	8,130
DeSoto	21,000	93	4,050	23,000	141	6,750
Jackson	....	.....	....	1,730	139	500
Lincoln	19,200	69	2,770	16,200	117	3,960
Sabine	4,170	105	910	5,400	189	2,120
Union	16,100	96	3,230	13,100	162	4,430
Webster	15,300	116	3,700	13,500	150	4,230
Total	120,070	94	23,690	116,330	140	34,170
Area 2						
Caldwell	....	.....	....	6,550	363	4,960
Grant	6,550	123	1,670	6,350	247	3,270
LaSalle	....	.....	....	500	253	260
Winn	2,340	48	240	1,610	172	580
Total	8,890	103	1,910	15,010	289	9,070
Area 3						
Bossier	32,500	120	8,100	36,600	257	19,600
Caddo	58,500	154	18,700	65,500	278	38,000
Natchitoches	41,900	177	15,400	41,500	297	25,700
Rapides	18,800	170	6,650	19,900	426	17,700
Red River	24,000	114	5,700	23,700	221	10,900
Total	175,700	148	54,550	187,200	286	111,900
Area 4						
Beauregard	....	.....	....	40	210	20
Vernon	....	.....	....	990	200	410
Total	....	.....	....	1,030	200	430
Area 5						
E. Baton Rouge	....	.....	....	990	149	310
E. Feliciana	7,700	57	910	7,700	142	2,280
W. Feliciana	....	.....	....	1,390	249	720
Total	7,700	57	910	10,080	157	3,310
Area 6						
Catahoula	16,500	122	4,200	15,000	280	8,750
Concordia	14,500	150	4,520	12,400	369	9,550
E. Carroll	34,800	131	9,500	35,200	341	25,100
Franklin	67,500	161	22,700	65,500	267	36,500
Madison	23,500	116	5,700	24,100	331	16,700
Morehouse	33,800	177	12,400	35,000	377	27,500
Ouachita	18,800	113	4,430	20,400	312	13,300
Richland	49,900	134	13,900	54,000	303	34,200
Tensas	28,200	175	10,300	30,900	305	19,700
W. Carroll	25,800	183	9,800	23,400	314	15,300
Total	313,300	149	97,450	315,900	313	206,600

(*Continued*)

TABLE 8—(continued)

	1946			1947		
	Acreage	Yield per acre	Production	Acreage	Yield per acre	Production
		Lbs.	*Bales*		*Lbs.*	*Bales*
Area 7						
Avoyelles	28,900	171	10,300	26,800	428	23,900
Evangeline	22,000	228	10,400	20,200	338	14,300
Lafayette	24,400	165	8,400	25,200	337	17,700
Pointe Coupee	11,500	177	4,240	12,700	386	10,200
St. Landry	45,700	160	15,200	50,000	352	36,700
Total	132,500	175	48,540	134,900	364	102,800
Area 8						
Ascension	....	.....	....	160	254	80
Assumption	....	.....	....	....	.....	....
Iberia	....	.....	....	1,410	277	820
Iberville	....	.....	....	460	396	380
Lafourche	....	.....	....	540	230	260
St. James	....	.....	....	....	.....	....
St. John	....	.....	....	....	.....	....
St. Martin	8,500	155	2,740	9,600	423	8,450
St. Mary	....	.....	....	....	.....	....
Terrebonne	....	.....	....	....	.....	....
W. Baton Rouge	....	.....	....	1,220	348	890
Total	8,500	155	2,740	13,390	388	10,880
Area 9						
Livingston	....	.....	....	290	217	130
St. Helena	....	.....	....	1,640	282	960
St. Tammany	....	.....	....	310	280	180
Tangipahoa	....	.....	....	1,330	189	520
Washington	11,000	48	1,110	8,150	188	3,200
Total	11,000	48	1,110	11,720	204	4,990
Area 10						
Jefferson	....	.....	....	....	.....	....
Orleans	....	.....	....	....	.....	....
Plaquemines	....	.....	....	....	.....	....
St. Bernard	....	.....	....	....	.....	....
St. Charles	....	.....	....	....	.....	....
Area 11						
Acadia	21,800	178	8,050	19,400	345	13,900
Allen	....	.....	....	730	247	380
Calcasieu	....	.....	....	330	256	180
Cameron	....	.....	....	1,060	301	670
Jefferson Davis	....	.....	....	1,170	275	670
Vermilion	9,150	144	2,740	9,750	249	5,050
Total	30,950	167	10,790	32,440	307	20,850
ALL OTHER	24,390	104	5,310	....	.....	....
STATE	833,000	142	247,000	838,000	289	505,000

Source: See following page.

TABLE 9. Cotton: Estimated Percentage of Total Lint Sales Made by Farmers each Month, Louisiana, 1924-48

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1924...	..	..	..	..	..	..	..	4	19	28	19	11	..
1925...	5	7	3	1	1	1	1	8	20	23	14	8	92
1926...	8	5	5	4	2	2	1	2	18	22	18	13	100
1927...	5	4	5	3	3	5	2	8	24	18	14	6	97
1928...	4	2	4	3	6	4	7	3	15	20	17	10	95
1929...	5	12	10	2	2	1	3	6	20	29	19	8	117
1930...	3	1	3	2	3	3	3	7	23	19	18	12	97
1931...	4	4	6	4	1	1	1	5	9	23	25	20	103
1932...	5	3	3	4	1	1	1	6	18	20	18	6	86
1933...	4	4	3	6	7	6	2	2	18	19	12	12	95
1934...	6	7	3	2	3	3	8	3	23	25	28	7	118
1935...	2	2	3	2	2	2	1	6	31	30	18	8	107
1936...	1	1	1	1	1	1	1	9	35	29	16	4	100
1937...	1	1	1	1	1	1	1	6	24	24	18	10	89
1938...	10	3	3	..	1	1	..	2	11	29	23	6	89
1939...	7	7	6	..	1	1	1	4	21	24	28	8	108
1940...	1	6	1	7	..	..	..	1	10	21	8	19	74
1941...	2	11	15	4	4	4	1	1	19	31	9	14	115
1942...	18	3	2	2	..	..	..	2	14	25	17	12	95
1943...	11	6	5	2	1	1	1	8	21	15	9	10	90
1944...	8	8	4	2	2	2	1	4	13	14	15	15	88
1945...	12	9	4	3	2	2	2	2	20	22	25	16	119
1946...	5	5	2	2	1	0	0	4	22	18	11	16	86
1947...	13	11	5	0	0	0	0	7	24	28	19	10	117
1948...	8	1	1	1	..	..	..	..	..	..	..	..	..
Av.	6.1	5.3	4.2	2.8	2.2	2.2	2.1	4.6	19.7	23.0	17.3	10.9	100.4

Source: Bureau of Agricultural Economics. Compiled as follows:

August 1924-July 1927, *Estimated Monthly Cotton Marketings by Farmers in Percentage of Year's Sales, Crop Years 1924-1936.* Published January 1938.

August 1928-July 1944, *Farm Production, Farm Disposition, and Value of Cotton and Cottonseed and Related Data, 1928-44.* Published October 1945.

August 1945-July 1946, *Cotton Production,* "Cotton and Cottonseed Production 1946." Published April 1947.

August 1946-April 1948, *Cotton Production,* "Cotton and Cottonseed Production, 1947." Published May 1948.

Source of data, Table 8: Compiled as follows from the Bureau of Agricultural Economics, U.S.D.A.:

1928-1937 from *Louisiana Cotton,* "Estimated Acreage, Yield, and Production by Parishes, 1928-1937." Published by Louisiana Office of Agricultural Estimates, January 1939.

1938-1939 from release by Louisiana Office of Agricultural Estimates.

1940-1942 from *Cotton,* "Acreage, Yield, and Production by Counties, 1940-41," and "1942-1943," released in Washington February 1943 and November 1944.

1943-1945 from mimeographed release "Louisiana Cotton, Estimated Planted Acreage, Planted Yields, and Production, 1943-1946," published by Louisiana Office of Agricultural Estimates, August 13, 1947.

1946-1947 from mimeographed release "Louisiana Cotton, Estimated Planted Acreage, Planted Yields, and Production, 1946-1947," published by Louisiana Office of Agricultural Estimates, July 14, 1948.

TABLE 10. Cotton: Estimated Percentage of Total Lint Sales Made by Farmers each Month, United States, 1924-48

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1924...	....	....	....	....	....	....	....	3.3	15.2	25.2	22.3	14.5	....
1925...	6.6	4.9	3.4	1.6	1.1	.9	1.0	6.5	19.3	23.1	17.6	12.0	98
1926...	6.6	4.2	3.1	2.2	1.7	2.1	1.6	2.7	15.2	22.0	19.6	12.5	94
1927...	6.3	5.8	4.9	3.8	3.1	2.5	1.6	6.6	20.0	23.8	17.3	9.7	105
1928...	4.2	4.0	4.2	3.1	2.7	2.3	2.1	4.6	15.6	24.8	20.8	12.8	101
1929...	5.4	4.0	4.8	1.8	1.6	1.9	1.9	5.7	18.3	28.3	20.6	11.7	106
1930...	4.2	2.6	2.3	1.4	1.4	1.6	1.9	7.7	19.0	25.6	20.3	11.7	100
1931...	3.9	2.8	2.4	1.8	1.6	1.8	1.4	2.9	13.4	23.9	20.5	13.6	90
1932...	6.4	5.9	5.1	2.6	1.7	1.8	2.2	4.1	14.3	23.0	20.0	10.9	98
1933...	4.0	3.4	3.3	4.9	5.6	3.9	2.6	6.1	16.2	21.0	15.3	7.9	94
1934...	2.4	4.4	6.6	4.1	1.3	2.5	9.1	5.0	12.9	27.9	25.0	11.8	113
1935...	5.0	2.6	3.0	2.2	1.4	1.9	1.3	4.5	18.5	30.2	22.2	10.5	103
1936...	4.6	2.2	2.0	1.5	1.4	1.1	1.3	5.3	21.5	28.9	22.4	11.2	103
1937...	2.9	2.1	1.5	1.0	1.0	1.2	1.0	5.9	17.3	25.1	22.9	13.7	96
1938...	6.6	3.6	2.6	1.2	.5	.5	.1	4.9	16.2	33.8	20.6	9.8	100
1939...	5.0	2.9	1.7	1.1	1.4	1.4	1.2	6.2	22.0	26.8	23.6	13.2	106
1940...	3.1	2.3	1.0	1.1	.2	.4	.1	2.9	10.5	22.8	17.9	10.8	73
1941...	4.5	4.5	7.0	4.4	5.1	7.3	2.3	1.7	15.5	21.6	17.4	10.2	102
1942...	5.9	4.3	5.1	4.9	2.9	1.0	.9	2.3	13.4	23.6	15.3	6.3	86
1943...	5.9	3.5	3.8	2.3	2.1	1.4	1.9	4.9	14.7	16.0	12.4	6.3	75
1944...	4.8	4.4	3.3	3.2	2.9	3.1	2.5	2.0	11.4	20.3	18.5	13.3	90
1945...	7.0	5.0	3.7	3.1	2.9	1.9	1.5	3.0	10.7	24.2	23.4	12.2	99
1946...	9.9	5.4	4.8	3.1	1.6	.9	.3	4.3	11.0	22.6	17.7	14.1	96
1947...	9.7	9.2	7.4	2.3	1.1	.3	.3	3.7	15.2	25.9	20.3	12.9	108
1948...	8.0	3.3	4.3	3.6	....	....	....	....	....	....	....	....	....
Av.	5.4	4.1	3.8	2.6	2.0	2.0	1.7	4.5	15.7	24.6	19.6	11.3	....

Source: Bureau of Agricultural Economics. Compiled as follows:

August 1924-July 1927, *Estimated Monthly Cotton Marketings by Farmers in Percentage of Year's Sales, Crop Years 1924-1936.* Published January 1938.

August 1927-July 1945, *Farm Production, Farm Disposition, and Value of Cotton and Cottonseed and Related Data, 1928-1944.* Published October 1945.

August 1945-July 1946, *Cotton Production,* "Cotton and Cottonseed Production, 1946." Published April 1947.

August 1946-April 1948, *Cotton Production,* "Cotton and Cottonseed Production, 1947." Published May 1948.

TABLE 11. Cotton Lint: Average Price per Pound Received by Louisiana Farmers on the 15th of each Month, August 1909-December 1948

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1909...	....	....	....	....	....	....	....	11.4	11.6	12.7	13.6	14.2	....
1910...	14.4	14.2	14.0	13.8	14.0	13.9	13.7	13.9	13.6	13.6	14.2	14.4	14.0
1911...	14.3	14.1	13.9	13.8	14.1	14.4	13.8	12.9	11.0	9.8	9.0	8.6	12.5
1912...	8.6	9.2	9.7	10.5	11.2	11.4	11.8	11.6	11.1	10.8	10.9	12.0	10.7
1913...	12.2	11.6	11.6	11.8	11.8	11.8	11.8	11.8	12.4	13.2	12.4	11.8	12.0
1914...	11.7	11.5	11.6	11.8	11.8	12.2	12.4	11.1	9.0	7.1	6.6	6.8	10.3
1915...	7.0	7.4	7.7	8.4	8.6	8.2	8.1	8.2	9.4	10.9	11.2	11.2	8.9
1916...	11.4	11.4	11.3	11.4	11.8	12.2	12.4	13.4	14.6	15.9	18.0	17.9	13.5
1917...	16.8	16.3	16.6	18.1	19.4	22.4	24.2	23.7	23.4	24.4	26.2	27.6	21.6
1918...	29.2	30.0	31.0	30.2	28.0	28.0	28.4	29.6	31.1	29.9	28.2	27.7	29.3
1919...	26.8	25.1	24.2	24.4	27.5	30.6	31.7	31.1	30.8	33.7	35.4	37.0	29.9
1920...	37.9	37.4	38.4	39.3	39.3	39.0	38.4	34.0	27.0	21.2	16.2	13.0	31.8
1921...	12.2	11.8	10.2	9.4	9.6	9.4	9.2	10.0	14.5	17.8	16.2	15.2	12.1
1922...	15.2	14.8	15.2	15.2	16.3	19.0	20.2	20.3	19.6	20.2	22.8	23.8	18.6
1923...	24.6	26.4	28.0	27.8	25.7	24.8	24.0	23.2	25.2	27.3	29.0	32.0	26.5
1924...	32.0	31.0	27.0	29.0	28.3	27.0	26.8	27.0	22.0	22.0	21.0	21.7	26.2
1925...	21.8	22.3	23.1	22.5	22.1	23.0	23.0	22.5	21.7	20.8	18.1	17.4	21.5
1926...	17.6	16.0	15.9	16.0	15.8	16.1	15.1	15.3	16.6	11.2	10.6	10.2	14.7
1927...	10.3	12.0	12.4	12.9	14.2	14.9	15.3	16.9	22.7	20.3	19.4	18.3	15.8
1928...	18.3	17.0	17.4	18.1	19.6	19.3	20.3	18.8	17.2	17.8	17.6	17.8	18.3
1929...	17.8	17.7	18.7	18.1	17.7	17.4	17.3	17.1	17.9	17.1	16.2	16.1	17.4
1930...	16.0	14.9	13.6	14.2	14.2	13.7	11.7	11.2	9.8	9.0	9.3	8.7	12.2
1931...	8.6	8.9	9.2	9.2	8.6	7.5	8.5	6.0	5.7	5.0	6.0	5.5	7.4
1932...	5.6	5.6	6.3	5.7	5.1	4.5	5.0	6.3	7.3	6.7	6.0	5.5	5.8
1933...	5.7	5.6	6.2	6.2	8.1	8.6	10.3	8.7	8.9	9.0	9.4	9.4	8.0
1934...	9.8	11.5	11.8	11.6	11.0	11.5	12.2	13.0	13.2	12.5	12.4	12.4	11.9
1935...	12.2	12.0	11.5	11.6	12.1	11.6	11.7	11.3	10.5	11.0	11.4	11.1	11.5
1936...	11.0	11.0	11.0	11.2	11.3	11.3	12.3	12.3	12.6	12.3	12.3	12.5	11.8
1937...	12.4	12.4	13.3	13.8	12.8	12.0	12.2	10.7	8.9	8.0	7.5	7.6	11.0
1938...	7.7	8.1	8.3	8.3	8.4	7.9	8.2	8.1	8.3	8.5	8.4	8.3	8.2
1939...	8.3	8.2	8.3	7.9	8.4	8.4	8.6	8.6	9.1	8.6	8.8	9.6	8.6
1940...	9.9	9.8	9.8	9.7	9.7	9.3	9.4	9.2	9.2	9.4	9.4	9.2	9.5
1941...	9.5	9.4	9.9	10.5	11.4	12.4	14.0	14.9	17.4	16.7	16.1	16.6	13.2
1942...	18.2	18.4	18.5	19.6	19.2	18.4	18.6	18.0	18.5	18.5	18.5	18.5	18.6
1943...	19.3	19.3	19.5	19.9	19.9	19.9	19.9	20.1	20.2	19.7	18.9	18.4	19.6
1944...	18.7	19.3	19.7	20.0	20.0	20.0	20.6	20.4	20.9	21.0	20.8	20.5	20.2
1945...	20.7	20.6	20.5	20.8	21.2	21.5	21.5	21.6	21.8	22.6	22.6	22.6	21.5
1946...	23.1	23.3	24.3	24.9	25.7	26.5	30.1	33.4	35.3	37.0	30.0	31.0	28.7
1947...	31.0	31.6	33.0	33.3	33.6	34.7	36.3	34.7	32.1	31.2	31.8	34.2	33.1
1948...	34.5	32.3	33.3	35.0	35.0	35.4	34.0	31.6	31.6	31.2	30.7	30.9	33.0
Av.	16.5	16.4	16.6	16.8	17.0	17.2	17.5	17.2	17.2	17.0	16.7	16.7	16.9

TABLE 12. Cotton Lint: Average Price per Pound Received by United States Farmers on the 15th of each Month, August 1909-December 1948

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
1909...	....	....	....	....	....	....	....	11.5	12.2	13.2	13.8	14.2	....
1910...	14.3	14.0	14.0	14.0	14.1	14.0	14.1	14.4	13.8	13.6	14.0	14.2	14.0
1911...	14.4	14.1	13.9	14.0	14.4	14.5	13.8	12.5	11.0	9.6	8.8	8.6	12.5
1912...	8.7	9.4	10.0	10.5	11.0	11.1	11.6	11.6	11.2	11.0	11.4	12.0	10.8
1913...	12.0	11.8	11.8	11.7	11.6	11.6	11.6	11.6	12.6	13.2	12.6	12.0	12.0
1914...	11.8	12.2	12.2	12.0	12.3	12.4	12.4	10.6	8.2	7.0	6.6	6.7	10.4
1915...	7.0	7.4	7.8	8.6	8.8	8.6	8.4	8.3	9.8	11.4	11.4	11.4	9.1
1916...	11.4	11.3	11.3	11.5	11.8	12.4	12.6	13.6	15.0	16.8	18.8	18.4	13.7
1917...	17.0	16.4	17.0	18.4	19.6	22.4	24.5	23.8	23.4	25.3	27.5	28.3	22.0
1918...	29.3	30.0	31.0	30.2	28.0	28.0	28.2	30.0	32.0	30.6	28.4	28.2	29.5
1919...	26.8	24.4	24.2	25.2	27.8	30.3	31.8	31.4	30.8	33.9	36.0	35.8	29.9
1920...	36.0	36.2	36.8	37.5	37.4	37.3	37.1	34.0	28.3	22.4	16.6	12.7	31.0
1921...	11.6	11.0	9.8	9.4	9.6	9.7	9.7	11.2	16.2	18.8	17.0	16.2	12.5
1922...	15.9	15.7	16.0	16.0	17.3	19.6	20.6	20.9	20.6	21.2	23.1	24.2	19.3
1923...	25.2	26.8	28.0	27.6	26.2	25.9	24.8	23.8	25.6	28.0	29.9	32.1	27.0
1924...	32.5	31.4	27.7	28.7	28.1	27.8	27.3	27.8	22.2	23.1	22.5	22.2	26.8
1925...	22.7	23.0	24.5	23.7	23.0	23.0	23.4	23.4	22.5	21.5	18.1	17.4	22.2
1926...	17.4	17.6	16.5	16.6	16.0	16.1	15.4	16.1	16.8	11.7	11.0	10.0	15.1
1927...	10.6	11.5	12.5	12.3	13.9	14.8	15.5	17.1	22.5	21.0	20.0	18.7	15.9
1928...	18.6	17.1	17.9	18.8	20.1	19.7	21.0	18.4	17.4	18.1	17.8	18.1	18.6
1929...	18.0	18.1	18.9	18.6	18.0	18.0	17.8	17.9	18.2	17.6	16.3	16.1	17.8
1930...	15.9	14.9	13.8	14.8	14.5	14.0	11.9	11.2	9.9	9.2	9.6	8.7	12.4
1931...	8.8	9.3	9.6	9.4	8.9	7.7	8.4	6.1	5.9	5.2	6.0	5.5	6.9
1932...	5.7	5.9	6.3	5.8	5.3	4.6	5.1	6.5	7.1	6.3	5.9	5.4	5.8
1933...	5.6	5.6	6.2	6.3	8.3	8.9	10.7	8.8	8.8	9.0	9.6	9.7	8.1
1934...	10.4	11.8	11.8	11.6	11.1	11.6	12.3	13.0	13.1	12.6	12.4	12.4	12.0
1935...	12.6	12.4	11.5	11.7	12.0	11.8	11.9	11.4	10.6	10.9	11.5	11.4	11.6
1936...	11.1	11.0	11.1	11.2	11.3	11.4	12.6	12.3	12.6	12.2	12.0	12.4	11.8
1937...	12.4	12.6	13.7	13.7	12.9	12.5	12.4	10.6	9.0	8.3	8.2	8.0	11.2
1938...	7.8	7.8	7.9	8.1	8.1	8.3	8.6	8.0	8.3	8.8	8.7	8.6	8.2
1939...	8.7	8.6	8.4	8.4	8.6	8.7	8.9	9.9	9.3	8.6	8.7	9.4	8.8
1940...	10.1	10.1	10.2	10.0	8.8	10.0	11.6	9.1	9.3	9.4	9.4	9.4	9.8
1941...	9.4	9.7	9.6	10.1	11.5	12.7	14.2	15.5	17.7	16.7	15.9	16.3	13.3
1942...	17.8	18.3	18.0	18.8	18.8	17.9	18.4	18.0	18.6	18.9	19.2	19.5	18.5
1943...	19.7	19.7	19.9	20.1	20.1	20.0	19.6	19.8	20.2	20.3	19.4	19.8	19.9
1944...	20.1	19.9	20.0	20.2	19.8	20.2	20.3	20.1	21.0	21.2	20.8	20.8	20.4
1945...	20.2	20.0	20.2	20.2	20.5	20.9	21.2	21.3	21.7	22.3	22.5	22.8	21.2
1946...	22.4	23.0	22.7	23.6	24.1	26.0	30.8	33.5	35.3	37.7	29.2	30.0	28.2
1947...	29.7	30.6	31.9	32.3	33.5	34.1	35.9	33.1	31.2	30.6	31.9	34.1	32.4
1948...	33.1	30.7	31.8	34.1	35.3	35.2	33.0	30.4	30.9	31.1	30.5	29.6	32.1
Av.	16.5	16.4	16.6	16.6	17.0	17.3	17.7	17.4	17.4	17.3	16.9	16.8	17.0

TABLE 13. Cotton, Middling: Average Spot Price per Pound at New Orleans, September 1900-March 1948

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1900...	......	......	......	......	......	......	......	......	10.39	9.57	9.48	9.50	......
1901...	9.52	9.20	8.49	8.15	7.69	8.05	8.33	8.28	8.15	7.99	7.32	7.93	8.26
1902...	7.88	8.08	8.54	9.13	9.39	9.15	8.94	8.43	8.43	8.22	7.82	8.14	8.51
1903...	8.66	9.36	9.73	10.05	11.14	12.71	13.02	12.70	10.72	9.66	10.72	12.52	10.92
1904...	14.06	14.38	15.07	14.45	13.41	11.38	10.86	10.59	10.54	9.80	9.50	7.48	11.79
1905...	6.83	7.45	7.45	7.39	7.90	8.87	10.61	10.48	10.26	10.16	11.28	11.88	9.21
1906...	11.56	10.67	10.84	11.28	11.33	10.99	10.96	9.99	9.24	10.76	10.39	10.53	10.71
1907...	10.46	10.49	10.83	10.79	11.85	12.81	12.89	13.13	12.41	11.19	10.84	11.54	11.60
1908...	11.84	11.63	10.93	10.20	10.86	11.59	10.81	9.92	9.11	8.92	8.97	8.78	10.30
1909...	9.34	9.42	9.39	10.03	10.59	11.04	12.13	12.28	12.66	13.48	14.40	14.96	11.64
1910...	15.23	14.88	14.74	14.64	14.89	14.85	14.93	14.92	13.49	14.21	14.50	14.85	14.68
1911...	14.95	14.62	14.54	14.70	15.48	15.26	14.30	11.96	11.29	9.61	9.35	9.17	12.94
1912...	9.53	10.31	10.65	11.61	11.72	12.07	12.93	12.07	11.37	10.95	12.15	12.81	11.51
1913...	12.58	12.61	12.45	12.44	12.29	12.44	12.34	12.02	13.11	13.73	13.26	12.98	12.69
1914...	12.93	12.90	12.95	13.11	13.36	13.79	13.34	[1]	[2]8.42	7.02	7.43	7.18	11.13
1915...	7.87	8.01	8.34	9.43	9.04	9.12	8.71	8.94	10.40	11.95	11.50	11.89	9.60
1916...	12.04	11.45	11.73	11.88	12.61	12.80	13.03	14.26	15.27	17.24	19.45	18.34	14.18
1917...	17.33	17.14	17.94	19.51	20.06	24.18	25.41	25.07	21.68	26.76	28.07	29.07	22.68
1918...	31.07	30.91	32.76	33.05	28.90	30.71	29.50	30.23	33.22	31.18	29.75	29.44	30.89
1919...	28.84	26.97	26.84	26.70	29.22	32.09	33.93	31.38	30.38	35.28	39.58	39.89	31.76
1920...	40.28	39.39	40.69	41.41	40.31	40.49	39.41	34.03	27.48	20.95	17.65	14.59	33.06
1921...	14.53	12.85	11.08	11.17	11.80	11.03	11.49	12.78	19.35	18.99	17.27	17.16	14.12
1922...	16.53	16.36	16.74	16.80	19.31	21.68	22.01	21.55	20.74	22.05	25.34	25.48	20.38
1923...	27.51	28.78	30.43	28.42	26.63	28.61	25.73	24.22	27.71	29.18	33.68	34.88	28.82
1924...	33.93	31.90	28.74	30.41	30.70	29.43	29.23	26.65	22.79	23.48	23.95	23.66	27.90
1925...	23.66	24.61	25.52	24.52	23.54	24.07	24.05	23.07	23.09	20.86	19.82	19.27	23.01
1926...	20.26	19.83	18.35	18.11	18.06	17.54	18.24	18.01	16.14	12.68	12.52	12.22	16.83
1927...	13.17	13.82	14.10	14.42	15.68	16.47	17.63	19.36	21.53	20.73	19.99	19.26	17.18
1928...	18.72	17.90	18.94	20.07	20.77	21.10	21.45	19.00	17.94	18.79	19.00	19.36	19.42
1929...	19.14	19.07	19.97	19.23	18.74	18.81	18.73	18.57	18.45	18.08	17.19	17.04	18.58
1930...	16.84	15.25	14.87	15.79	15.60	13.56	12.65	11.56	10.58	10.40	10.63	9.65	13.12
1931...	9.87	10.63	10.59	9.95	9.08	8.86	9.10	7.02	6.20	6.06	6.32	6.10	8.32
1932...	6.50	6.69	6.74	6.12	5.70	5.18	5.73	7.29	7.58	6.51	6.12	5.84	6.33
1933...	6.12	5.92	6.32	6.88	8.58	9.33	10.68	9.48	9.38	9.29	9.74	9.94	8.47
1934...	10.95	12.07	12.16	11.81	11.39	12.13	12.75	13.28	13.01	12.58	12.59	12.78	12.29
1935...	12.70	12.58	11.57	11.81	12.31	11.96	12.15	11.36	10.68	11.16	12.00	11.82	11.84
1936...	11.71	11.38	11.46	11.60	11.62	12.12	12.92	12.12	12.28	12.26	12.21	12.67	12.03
1937...	13.03	13.06	14.19	13.94	13.13	12.50	12.12	10.34	8.84	8.23	7.98	8.32	11.31
1938...	8.69	9.08	9.07	8.94	8.62	8.47	8.91	8.40	7.99	8.53	8.72	8.49	8.66
1939...	8.60	8.60	8.69	8.61	9.30	9.45	9.37	8.95	9.02	8.92	9.40	10.64	9.13
1940...	10.79	10.67	10.43	10.54	10.05	10.54	10.35	9.72	9.34	9.27	9.57	9.74	10.08
1941[3]...	9.90	10.02	10.59	10.87	12.24	13.55	15.38	16.10	16.95	16.28	16.34	17.18	13.78
1942...	18.90	19.19	19.42	19.50	19.30	18.20	19.28	18.50	18.64	18.79	19.16	19.51	19.03
1943...	20.27	20.59	20.97	20.95	20.78	20.84	20.53	20.18	20.20	20.15	19.52	19.46	20.37
1944...	19.92	20.50	20.89	20.86	20.80	21.36	21.49	21.28	21.24	21.46	21.22	21.38	21.03
1945...	21.45	21.39	21.57	21.93	22.40	22.55	22.41	22.21	22.34	22.96	23.80	24.30	22.44
1946...	24.59	25.70	26.65	27.52	27.35	29.06	33.41	35.45	36.86	35.94	30.70	32.14	30.45
1947...	31.68	33.12	34.93	35.03	35.87	37.05	37.04	34.02	31.37	31.55	33.42	35.63	34.22
1948...	34.98	32.63	33.99	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Av.	15.78	15.80	15.95	16.08	16.20	16.59	16.83	16.33	15.91	15.83	16.00	16.12	16.11

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[1] Market closed.

[2] No quotations prior to September 23. Average for 7 days' business.

[3] Prior to August 1941 prices are for ⅞-inch cotton; thereafter, 15/16-inch cotton.

Source: September 1900 through July 1909 from *Yearbook of Agriculture*, 1923, p. 809.
August 1909 through July 1928 from *Yearbook of Agriculture*, 1931, p. 682.
August 1928 through July 1937 from *Agricultural Statistics*, 1939, p. 115.
August 1937 through March 1948 from *Commodity Yearbook*, 1948, p. 192.

TABLE 14. Cotton, Middling: Average Spot Price per Pound at 10 Markets, August 1915-March 1948*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
1915...	.....	.....	.....	.....	.....	.....	.....	8.80	10.29	11.99	11.49	11.97	.....
1916...	12.10	11.54	11.78	11.94	12.67	12.89	13.11	14.32	15.31	17.38	19.54	18.44	14.25
1917...	17.70	16.54	18.29	19.72	20.15	24.33	25.45	25.26	22.08	26.86	28.21	29.19	22.82
1918...	31.05	30.97	32.84	32.87	29.32	30.10	29.44	31.05	33.38	31.11	29.27	29.22	30.88
1919...	28.51	26.55	26.40	26.84	29.21	31.84	33.80	31.50	30.30	35.44	39.59	39.70	31.64
1920...	40.46	39.49	40.68	41.74	41.01	40.58	39.58	34.78	28.24	21.38	17.83	14.63	33.37
1921...	14.42	12.93	11.19	11.01	11.55	10.77	11.13	12.53	19.50	19.25	17.43	17.47	14.10
1922...	17.04	16.73	17.12	16.92	19.22	21.58	22.27	21.53	20.72	22.11	25.20	25.40	20.49
1923...	27.39	28.62	30.21	28.28	26.47	28.20	25.87	24.22	27.67	28.90	33.30	34.39	28.63
1924...	33.69	31.73	28.54	30.25	30.32	29.37	29.32	27.16	22.74	23.29	23.63	23.40	27.79
1925...	23.52	24.51	25.51	24.56	23.61	24.19	24.55	23.35	23.23	20.95	19.92	19.31	23.10
1926...	20.04	19.63	18.33	18.05	17.95	17.52	17.92	17.65	15.96	12.40	12.17	11.81	16.66
1927...	12.72	13.45	13.74	14.08	15.38	16.10	17.34	19.16	21.19	20.35	19.74	18.99	16.85
1928...	18.44	17.60	18.76	19.76	20.54	20.82	21.25	18.72	17.72	18.46	18.70	19.07	19.15
1929...	18.88	18.86	19.78	18.95	18.23	18.36	18.29	18.04	18.01	17.62	16.75	16.64	18.20
1930...	16.56	15.11	14.74	15.40	15.12	13.21	12.21	11.14	10.15	9.82	10.09	9.16	12.73
1931...	9.37	10.12	10.15	9.50	8.70	8.42	8.66	6.57	5.83	5.75	5.95	5.78	7.90
1932...	6.15	6.40	6.44	5.83	5.41	4.99	5.54	7.08	7.40	6.37	6.03	5.72	6.11
1933...	6.01	5.85	6.19	6.84	8.49	9.28	10.52	9.24	9.19	9.16	9.65	9.87	8.36
1934...	10.91	12.02	12.09	11.66	11.28	12.04	12.58	13.12	12.85	12.40	12.46	12.60	12.17
1935...	12.55	12.47	11.57	11.80	12.33	11.97	12.22	11.37	10.48	10.96	11.77	11.70	11.77
1936...	11.62	11.32	11.38	11.57	11.56	11.96	12.90	12.07	12.05	12.07	12.06	12.60	11.93
1937...	12.84	12.90	14.15	13.91	13.12	12.50	12.12	10.23	8.72	8.14	7.84	8.16	11.22
1938...	8.54	8.92	8.89	8.75	8.51	8.39	8.83	8.37	8.10	8.55	8.65	8.45	8.58
1939...	8.54	8.52	8.64	8.51	9.16	9.50	9.37	8.98	8.88	8.83	9.22	10.38	9.04
1940...	10.62	10.62	10.42	10.44	9.93	10.29	10.19	9.72	9.28	9.17	9.45	9.65	9.98
1941†...	9.89	9.92	10.37	10.88	12.23	13.57	15.36	16.14	17.10	16.49	16.38	17.26	13.80
1942...	18.99	19.23	19.55	20.23	20.01	18.94	19.42	18.57	18.72	18.89	19.27	19.67	19.29
1943...	20.44	20.71	21.16	21.20	21.12	21.11	20.85	20.45	20.44	20.32	19.70	19.68	20.60
1944...	20.17	20.81	21.07	21.04	21.01	21.52	21.64	21.41	21.40	21.59	21.38	21.55	21.22
1945...	21.66	21.59	21.75	22.12	22.58	22.69	22.59	22.38	22.50	23.13	23.93	24.51	22.62
1946...	24.71	25.84	26.79	27.70	27.44	29.15	33.40	35.49	36.88	36.07	30.89	32.38	30.56
1947...	31.88	33.31	35.15	35.13	35.99	37.18	37.52	34.34	31.56	31.73	33.61	35.79	34.43
1948...	35.15	32.76	34.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Av.	18.04	17.96	18.24	18.36	18.42	18.86	19.23	18.62	18.36	18.28	18.42	18.52	18.44

*Norfolk, Augusta, Savannah, Montgomery, New Orleans, Memphis, Little Rock, Dallas, Houston, and Galveston.

†Prior to August 1941 prices are for ⅞-inch cotton; thereafter, $^{15}/_{16}$-inch cotton.

Source: August 1915-July 1919 from *Yearbook of Agriculture*, 1931, p. 682.
August 1919-July 1928 from *Yearbook of Agriculture*, 1935, p. 433.
August 1928-Dec. 1938 from *Agricultural Statistics*, 1939, p. 115.
January 1939-July 1941 from *Agricultural Statistics*, 1942, p. 117.
August 1941-March 1948 from *Commodity Yearbook*, 1948, p. 192.

TABLE 15. Cottonseed: Production, Farm Price, Quantity Crushed, and Products Obtained, United States, 1874-1947

Year beginning August	Production	Season average price received by farmers	Quantity crushed	Products obtained			
				Oil	Cake and meal	Hulls	Linters[1]
	1,000 tons	*Dollars per ton*	*1,000 tons*	*1,000 gallons*	*1,000 tons*	*1,000 tons*	*1,000 bales*
1874	1,687	.....	84	3,370	30	.....	.....
1875	2,057	.....	123	4,940	43	.....	.....
1876	1,969	.....	98	3,940	34	.....	.....
1877	2,148	.....	150	6,020	53	.....	.....
1878	2,268	.....	181	7,260	64	.....	.....
1879	2,616	.....	235	9,420	82	.....	.....
1880	3,039	.....	182	7,290	64	.....	.....
1881	2,455	.....	295	11,780	103	.....	.....
1882	3,266	.....	392	15,680	137	.....	.....
1883	2,639	.....	396	15,840	138	.....	.....
1884	2,625	.....	499	19,950	174	.....	.....
1885	3,045	.....	578	23,140	202	.....	.....
1886	3,018	.....	694	27,770	243	.....	.....
1887	3,291	.....	823	32,910	288	.....	.....
1888	3,310	.....	794	31,770	278	.....	.....
1889	3,495	.....	874	34,950	306	.....	.....
1890	4,093	.....	1,023	40,930	358	.....	.....
1891	4,274	.....	1,068	42,740	374	.....	.....
1892	3,183	.....	1,050	42,010	368	.....	.....
1893	3,579	.....	1,431	57,260	501	.....	.....
1894	4,792	.....	1,677	67,090	587	.....	.....
1895	3,416	.....	1,435	57,390	502	.....	.....
1896	4,070	.....	1,628	65,120	570	.....	.....
1897	5,253	.....	2,101	84,040	735	.....	.....
1898	5,472	.....	2,353	94,110	823	.....	.....
1899	4,668	.....	2,479	93,330	884	1,169	115
1900	4,830	.....	2,415	96,610	845	1,139	111
1901	4,630	.....	3,154	118,610	1,125	1,487	145
1902	5,092	.....	3,269	122,910	1,165	1,541	150
1903	4,716	.....	3,241	121,880	1,156	1,528	194
1904	6,427	.....	3,345	133,820	1,360	1,213	236
1905	5,060	.....	3,131	125,700	1,272	1,135	219
1906	5,913	.....	3,844	153,760	1,563	1,393	308
1907	4,952	.....	2,565	103,050	1,043	927	256
1908	5,904	.....	3,670	146,790	1,492	1,330	320
1909	4,462	24.35	3,269	131,000	1,326	1,189	297
1910	5,175	26.11	4,106	167,970	1,792	1,375	380
1911	6,997	17.18	4,921	201,650	2,151	1,642	533
1912	6,104	18.36	4,580	185,750	1,999	1,540	583
1913	6,305	21.96	4,848	193,330	2,220	1,400	660
1914	7,186	15.51	5,780	229,260	2,648	1,677	820
1915	4,992	30.15	4,202	167,110	1,923	1,220	890
1916	5,113	45.63	4,479	187,688	2,225	969	1,273
1917	5,040	64.28	4,252	174,996	2,068	996	1,081
1918	5,360	65.23	4,479	176,711	2,170	1,137	890
1919	5,074	65.79	4,013	161,529	1,817	1,143	584

(Continued)

TABLE 15—(continued)

Year beginning August	Production	Season average price received by farmers	Quantity crushed	Products obtained			
				Oil	Cake and meal	Hulls	Linters[1]
	1,000 tons	*Dollars per ton*	*1,000 tons*	*1,000 gallons*	*1,000 tons*	*1,000 tons*	*1,000 bales*
1920	5,966	25.65	4,069	174,558	1,786	1,256	429
1921	3,528	29.14	3,008	124,063	1,355	937	382
1922	4,330	30.42	3,242	133,723	1,487	944	591
1923	4,503	41.23	3,308	130,616	1,518	941	640
1924	6,050	33.25	4,605	187,171	2,126	1,331	858
1925	7,150	31.59	5,558	215,602	2,597	1,547	1,044
1926	7,989	22.04	6,306	251,721	2,840	1,854	1,042
1927	5,758	34.83	4,654	196,881	2,093	1,320	875
1928	6,319	34.17	5,061	213,884	2,282	1,368	1,086
1929	6,406	30.92	5,016	209,643	2,232	1,384	1,038
1930	6,028	22.04	4,715	192,251	2,165	1,304	824
1931	7,310	8.97	5,328	225,883	2,401	1,511	876
1932	5,815	10.33	4,621	192,757	2,093	1,312	741
1933	5,511	12.88	4,157	173,705	1,889	1,103	801
1934	4,256	33.00	3,550	147,811	1,614	913	805
1935	4,634	30.54	3,818	155,165	1,739	988	876
1936	5,472	33.36	4,498	181,864	2,031	1,144	1,127
1937	7,844	19.51	6,326	261,531	2,830	1,626	1,471
1938	4,950	21.79	4,471	187,922	2,023	1,161	1,113
1939	4,869	21.17	4,151	176,699	1,882	1,055	1,072
1940	5,286	21.73	4,398	190,063	1,954	1,107	1,208
1941	4,553	47.65	4,008	166,650	1,753	992	1,183
1942	5,202	45.61	4,498	186,738	1,995	1,085	1,354
1943	4,688	52.10	3,955	164,777	1,834	927	1,180
1944	4,902	52.70	4,254	176,539	1,954	984	1,247
1945	3,664	51.10	3,262	135,673	1,434	783	989
1946	3,513	72.00	3,090	129,744	1,363	727	992
1947	4,681	85.90	4,081	169,937	1,898	922	1,281

[1] Bales are 500 pounds net from 1874-1919; running bales 1920-1947.

Source: 1874-1898—Gilbeart H. Collings, *The Production of Cotton.* New York: John Wiley and Sons, Inc., 1926, pp. 232-33.

1899-1919—*Yearbook of Agriculture,* 1923, except linters' production, which was taken from *The Production of Cotton* by Collings, and oil (source below).

1920-1942—*The Cotton Situation,* "An Analysis and Statement of the Statistics Relating to Cotton, 1919-1944." Prepared by Wells and Porter for the Special Committee on Agriculture on Post-War Farm Programs—Hearings on December 4, 1944. Data on oil (1920-47) were taken from Bureau of Census Bulletin, "Cotton Production and Distribution," in pounds and converted to gallons allowing 7.5 pounds per gallon.

1943-45—*Agricultural Statistics,* 1946.

1946-47—Louisiana Office of Agricultural Estimates, B.A.E., U.S.D.A.

TABLE 16. Cottonseed: Production, Disposition, Price, and Farm Value, Louisiana, 1909-47

Year beginning August	Production	Left on farms	Sold to oil mills[1]	Exchanged for meal	Season average price received by farmers per ton	Value of	
						Production	Sales
	1,000 tons	*1,000 tons*	*1,000 tons*	*1,000 tons*	*Dollars per ton*	*1,000 dollars*	*1,000 dollars*
1909	112	27	85	5	22.70	2,542	1,930
1910	109	29	80	5	25.64	2,795	2,051
1911	171	46	125	10	18.03	3,083	2,258
1912	167	35	132	12	18.79	3,138	2,480
1913	197	37	160	10	18.74	3,692	2,998
1914	199	24	175	10	15.26	3,037	2,670
1915	151	26	125	5	27.26	4,116	3,408
1916	197	27	170	5	42.83	8,438	7,281
1917	284	34	250	2	60.94	17,307	15,235
1918	261	31	230	5	64.69	16,884	14,879
1919	132	32	100	5	64.48	8,511	6,448
1920	172	47	125	10	29.07	5,000	3,634
1921	124	24	100	10	27.39	3,396	2,739
1922	152	32	120	10	28.12	4,274	3,374
1923	163	38	125	5	40.35	6,577	5,044
1924	219	44	175	5	31.18	6,828	5,456
1925	404	53	351	11	30.68	12,395	10,769
1926	368	44	324	10	21.25	7,820	6,885
1927	243	46	197	4	32.77	7,963	6,456
1928	326	51	275	8	31.76	10,354	8,734
1929	376	76	300	12	29.60	11,130	8,880
1930	330	75	255	17	21.28	7,022	5,426
1931	416	96	320	29	7.67	3,191	2,454
1932	290	60	230	16	10.11	2,932	2,325
1933	223	43	180	9	12.20	2,721	2,196
1934	225	30	195	4	31.78	7,150	6,197
1935	251	41	210	13	30.35	7,618	6,374
1936	349	64	285	11	33.77	11,786	9,624
1937	454	74	380	25	18.79	8,531	7,140
1938	278	43	235	16	20.58	5,721	4,836
1939	304	39	265	19	19.24	5,849	5,099
1940	191	28	163	8	20.32	3,881	3,312
1941	135	20	115	3	47.54	6,418	5,467
1942	243	23	220	7	44.44	10,799	9,777
1943	299	39	260	8	51.60	15,428	13,416
1944	250	25	225	8	50.20	12,550	11,295
1945	163	23	140	6	49.80	8,104	6,972
1946	103	18	85	5	61.90	6,376	5,262
1947	201	26	175	5	79.80	16,040	13,965

[1] Includes quantity exchanged for meal.

Source: 1909-27 from *Disposition of Cottonseed, 1909-1936, by States.* Published by Bureau of Agricultural Economics, October 1937.

1928-44 from *Farm Production, Disposition, and Value of Cotton and Cottonseed and Related Data, 1928-44.* Published by B.A.E., October 1945.

1945 from *Agricultural Statistics*, 1946.

1946-47 from *Cotton Production*, "Cotton and Cottonseed Production, 1947." Mimeographed release of B.A.E., published May 7, 1948.

TABLE 17. Cottonseed: Production, Disposition, Price, and Farm Value, United States, 1909-1947

Year beginning August	Production	Left on farms	Sold to oil mills[1]	Exchanged for meal	Season average price received by farmers per ton	Value of	
						Production	Sales
	1,000 tons	*1,000 tons*	*1,000 tons*	*1,000 tons*	*Dollars per ton*	*1,000 dollars*	*1,000 dollars*
1909	4,442	1,173	3,269	312	24.15	107,256	78,946
1910	5,156	1,050	4,106	262	25.99	134,023	106,715
1911	6,970	2,049	4,921	425	17.15	119,532	84,395
1912	6,087	1,508	4,579	379	18.33	111,575	83,933
1913	6,286	1,440	4,846	343	21.90	137,688	106,127
1914	7,155	1,385	5,770	443	15.46	110,604	89,204
1915	4,963	770	4,193	264	30.13	149,558	126,335
1916	5,085	588	4,497	245	45.70	232,408	205,513
1917	5,012	755	4,257	176	64.30	322,252	273,725
1918	5,341	884	4,457	230	65.16	348,044	290,418
1919	5,069	1,076	3,993	269	65.59	332,451	261,901
1920	5,966	1,866	4,100	509	25.65	153,047	105,165
1921	3,528	633	2,895	336	29.07	102,570	84,158
1922	4,330	1,113	3,217	310	30.33	131,337	97,572
1923	4,503	1,225	3,278	259	41.21	185,576	135,086
1924	6,050	1,463	4,587	294	33.25	201,179	152,518
1925	7,150	1,635	5,515	351	31.69	226,552	174,770
1926	7,989	1,625	6,364	412	22.08	176,388	140,517
1927	5,758	1,172	4,586	322	34.86	200,698	159,868
1928	6,319	1,234	5,085	331	34.17	216,191	173,754
1929	6,406	1,384	5,022	330	20.92	198,164	155,288
1930	6,028	1,333	4,695	417	22.04	133,054	103,492
1931	7,310	1,690	5,620	825	8.97	65,678	50,432
1932	5,815	1,272	4,543	545	10.33	60,202	46,945
1933	5,511	1,352	4,159	363	12.88	71,166	53,571
1934	4,356	838	3,418	207	33.00	140,574	112,782
1935	4,634	884	3,750	300	30.54	141,527	114,522
1936	5,472	953	4,519	304	33.36	182,230	150,767
1937	7,844	1,223	6,621	658	19.51	152,974	129,208
1938	4,950	690	4,260	445	21.79	107,874	92,806
1939	4,869	799	4,070	433	21.17	102,933	86,150
1940	5,286	796	4,490	492	21.73	114,817	97,552
1941	4,553	593	3,960	212	47.65	216,961	188,691
1942	5,202	686	4,516	365	45.61	237,221	205,974
1943	4,688	704	3,984	431	52.10	244,059	207,472
1944	4,902	540	4,362	298	52.70	258,163	229,690
1945	3,664	502	3,162	318	51.10	187,155	161,578*
1946	3,513	444	3,069	215	72.00	252,674	220,932
1947	4,679	600	4,079	141	85.90	401,737	350,408

*Estimate.

[1] Includes quantity exchanged for meal.

Source: Production, Left on farms, Sold to oil mills, 1909-27 were compiled from *Disposition of Cottonseed,* published by Bureau of Agricultural Economics, October 1937; season average price and value of production were compiled from *Agricultural Statistics,* 1946. Value of sales was computed by multiplying the amount sold to oil mills by season average price.

1928-44—data were compiled from *Farm Production, Disposition and Value of Cotton and Cottonseed and Related Data,* 1928-44. Published by Bureau of Agricultural Economics, Oct. 1945.

1945—data were compiled from *Agricultural Statistics,* 1946.

1946-47—*Cotton Production,* "Cotton and Cottonseed Production, 1947." Published by Bureau of Agricultural Economics, May 1948.

TABLE 18. Cottonseed: Average Price per Ton Received by Farmers on the 15th of each Month, Louisiana, August 1909-December 1948

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
	Dollars per ton												
1909...	......	......	......	......	......	......	......	11.40	11.60	12.70	13.60	14.20	......
1910...	26.50	26.00	27.00	28.00	28.50	29.00	28.50	25.80	25.80	26.30	24.80	24.90	26.75
1911...	26.20	24.50	24.30	24.50	22.50	20.30	21.20	24.00	18.00	17.00	18.90	18.50	21.65
1912...	17.18	18.40	18.30	18.10	19.30	17.00	18.30	19.30	18.10	18.40	19.19	19.70	18.45
1913....	20.20	21.80	21.50	21.70	22.50	19.60	18.50	20.00	19.70	19.00	18.00	18.50	20.10
1914...	17.60	18.00	18.20	20.10	22.10	18.00	20.00	21.00	13.20	16.10	13.60	17.80	18.00
1915....	19.00	20.50	20.60	20.20	21.10	19.80	19.00	17.00	21.10	30.60	34.10	34.60	23.15
1916...	35.00	40.00	34.80	40.70	32.50	35.00	36.50	36.50	36.50	45.00	57.00	57.00	40.55
1917...	50.00	45.30	52.70	55.30	58.40	58.00	54.30	60.00	53.50	62.50	66.30	65.75	56.85
1918...	66.25	67.20	68.80	69.00	71.00	68.50	65.00	57.00	67.00	67.00	64.00	61.00	66.00
1919...	61.00	61.00	62.10	63.00	63.00	62.40	62.00	63.00	60.00	62.90	69.70	68.60	63.20
1920...	66.10	65.00	71.00	75.00	70.80	66.70	65.00	55.40	34.70	27.90	27.80	21.40	53.90
1921...	20.40	19.50	19.10	18.70	17.20	18.10	17.50	21.40	26.60	28.00	29.10	24.60	21.70
1922...	25.60	25.80	25.50	32.70	33.50	33.40	29.80	25.00	27.00	27.90	34.70	42.60	30.30
1923...	38.00	35.00	35.00	38.70	37.80	36.00	38.00	40.00	40.00	40.00	42.00	41.00	38.45
1924...	40.00	39.00	45.00	43.00	41.50	40.00	40.00	35.00	31.00	30.00	30.50	32.00	37.25
1925...	35.00	33.50	34.00	33.60	35.50	32.00	40.00	32.30	33.20	29.70	24.50	23.00	32.20
1926...	25.00	27.80	28.10	27.60	27.10	29.30	32.80	28.00	25.10	18.30	17.70	17.40	25.35
1927...	18.10	22.20	23.00	24.40	24.10	24.00	25.00	25.20	33.70	34.60	34.20	36.00	27.05
1928...	36.50	35.00	35.00	36.00	39.00	39.00	39.00	37.00	30.00	32.00	35.00	35.00	35.70
1929...	35.00	35.00	37.00	36.00	35.00	34.00	33.00	29.00	29.00	31.00	30.00	31.00	32.90
1930...	31.00	30.00	31.00	31.00	31.00	29.00	27.00	23.00	23.00	19.00	19.00	19.00	26.10
1931....	20.00	20.00	21.00	21.00	21.00	19.00	19.40	13.60	8.00	6.50	8.80	9.10	15.60
1932...	9.40	9.30	9.80	9.50	9.20	8.30	8.50	8.50	10.60	10.20	9.30	9.00	9.30
1933...	9.10	9.00	9.20	10.00	11.50	12.00	14.00	14.00	11.50	12.75	12.90	13.00	11.60
1934...	15.50	16.00	17.75	18.00	19.00	18.50	19.00	25.00	33.00	34.00	36.00	36.00	24.00
1935...	38.00	38.00	38.00	36.00	37.00	36.00	36.00	29.00	29.00	33.00	34.00	34.00	34.80
1936...	34.00	34.00	34.00	35.00	34.00	33.00	33.00	33.00	34.00	34.00	34.00	35.00	33.90
1937...	36.00	37.00	37.00	38.00	38.00	35.00	34.00	24.00	18.00	17.00	18.00	18.00	29.15
1938...	17.00	19.00	20.00	20.00	29.00	21.00	21.00	21.00	20.00	22.00	22.20	23.00	21.25
1939...	23.00	23.00	22.30	23.00	22.50	23.00	20.50	13.40	20.30	22.20	22.20	23.10	21.55
1940...	24.20	24.70	25.20	25.50	25.50	24.40	24.00	22.00	19.70	20.50	22.00	22.80	23.40
1941...	24.40	24.00	25.00	26.20	27.80	28.90	34.20	35.60	47.00	52.00	49.00	48.20	35.20
1942...	47.90	48.20	48.80	49.20	49.00	46.00	46.00	45.00	44.00	45.00	44.00	44.00	46.40
1943...	45.00	45.00	46.00	46.50	47.10	47.30	46.50	51.00	52.00	52.00	51.00	49.00	48.20
1944...	50.00	50.00	51.00	51.00	51.00	52.00	53.00	51.00	51.00	49.00	50.00	50.00	50.75
1945...	51.00	51.00	51.00	52.00	52.00	53.00	53.00	51.00	49.00	50.00	51.00	52.00	51.55
1946...	52.00	51.00	51.00	52.00	52.00	53.00	57.00	58.00	58.00	63.00	91.00	93.00	60.90
1947...	91.00	89.00	91.00	90.00	84.00	74.00	74.00	69.00	76.00	89.00	87.00	89.00	83.60
1948...	92.00	90.00	89.00	91.00	92.00	90.00	92.00	71.00	67.00	62.00	66.00	69.00	80.90
Av.	35.60	35.60	36.40	37.20	37.30	36.00	36.30	34.10	33.70	34.80	37.40	36.60	35.90

Source: Louisiana Office of Agricultural Estimates, Bureau of Agricultural Economics, United States Department of Agriculture.

TECHNOLOGY AND SCIENCE ROOM

TABLE 19. Cottonseed: Average Price per Ton Received by Farmers on the 15th of each Month, United States, September 1910-December 1948

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
	Dollars per ton												
1910...	.....	.....	.....	.....	.....	.....	.....	.....	26.23	26.86	25.36	25.65	.....
1911...	26.35	25.61	25.49	26.12	25.46	23.38	22.70	20.45	18.09	16.73	16.69	16.70	22.00
1912...	16.57	16.81	18.21	18.62	19.21	19.24	19.04	18.02	17.61	18.04	18.57	21.42	18.45
1913...	21.98	22.01	21.55	21.89	21.88	21.54	21.37	20.24	21.07	22.01	22.46	23.48	21.80
1914...	22.70	23.37	23.60	24.17	23.56	23.62	22.78	20.16	13.88	15.28	14.01	17.73	20.40
1915...	19.14	23.33	22.32	22.69	22.07	20.82	20.05	20.14	20.98	33.73	34.01	35.54	24.55
1916...	36.85	36.75	36.56	38.13	37.91	35.79	36.06	35.22	41.13	47.19	55.82	56.35	41.15
1917...	52.53	51.43	53.18	55.94	55.61	57.19	56.90	56.61	57.58	65.02	69.38	68.29	58.30
1918...	67.51	66.95	68.27	68.08	68.16	66.03	64.11	61.34	67.90	65.85	64.97	65.05	66.20
1919...	64.93	64.65	64.00	64.28	63.83	63.80	64.24	66.23	62.13	66.95	72.65	69.07	65.55
1920...	69.88	69.34	67.18	68.71	69.88	66.16	61.64	43.22	29.96	28.94	26.00	19.83	51.75
1921...	18.96	19.76	18.92	17.23	17.28	17.06	18.75	22.06	27.19	31.05	29.15	28.78	22.20
1922...	29.24	30.17	32.72	40.79	40.21	37.71	36.92	32.44	25.37	31.79	40.18	42.93	35.05
1923...	43.35	45.16	46.32	47.60	46.58	43.14	41.42	37.47	40.88	40.90	45.92	45.54	43.70
1924...	44.37	43.27	41.34	40.42	40.53	39.96	39.07	38.44	31.74	31.95	33.57	35.48	38.35
1925...	37.50	37.14	38.21	37.94	38.61	36.66	36.41	36.52	33.48	32.82	27.64	27.87	35.05
1926...	28.40	29.06	29.47	31.51	30.84	31.89	31.31	29.73	27.38	20.06	18.66	18.05	27.20
1927...	18.55	22.39	25.43	25.80	26.05	26.27	24.70	25.69	34.89	36.56	37.30	36.75	28.35
1928...	36.25	36.45	36.98	38.56	42.11	40.20	37.01	34.51	30.69	34.17	37.13	37.31	36.80
1929...	37.22	37.43	37.58	37.31	35.81	34.43	33.99	31.96	31.27	31.34	30.24	29.85	34.05
1930...	28.04	27.45	27.41	28.60	29.68	28.83	27.00	23.26	23.86	20.40	21.22	21.12	25.57
1931...	20.97	21.61	22.09	22.30	21.73	20.02	18.00	13.53	8.77	7.38	11.01	10.57	16.50
1932...	9.98	9.66	9.55	9.33	9.65	8.83	7.79	8.65	11.43	10.38	9.33	8.70	9.45
1933...	8.55	8.53	8.78	9.57	11.34	12.18	15.00	14.83	12.24	12.42	13.23	14.46	11.75
1934...	14.69	16.79	18.17	19.09	19.55	19.26	22.48	26.76	31.96	35.04	36.58	39.34	25.00
1935...	38.56	38.19	37.07	36.68	36.27	34.92	33.00	28.41	27.87	32.14	33.32	32.02	34.05
1936...	29.75	29.20	29.15	29.39	28.72	27.31	28.00	31.87	33.77	33.36	33.13	34.79	30.70
1937...	36.57	37.19	37.33	37.82	37.42	35.62	33.00	24.47	19.22	18.40	19.02	18.55	29.55
1938...	18.63	19.26	20.21	20.55	21.63	21.29	21.00	21.22	21.23	22.35	22.94	23.09	21.15
1939...	23.28	22.96	23.06	22.95	22.87	22.72	20.70	15.91	20.65	22.89	23.73	24.73	22.20
1940...	26.55	27.00	27.09	27.18	26.69	25.54	22.60	20.62	20.44	21.54	23.00	24.17	24.35
1941...	24.16	24.02	24.23	25.88	27.67	29.58	35.90	36.94	49.83	50.89	45.28	44.65	34.90
1942...	43.24	45.04	44.18	43.90	43.99	43.87	43.20	44.04	45.33	46.46	45.01	44.72	44.40
1943...	44.34	44.88	45.73	45.89	46.10	46.40	44.50	50.90	51.90	52.50	52.50	52.60	48.20
1944...	52.80	52.60	52.70	52.50	52.50	52.80	53.00	53.20	52.30	52.70	53.40	53.10	52.80
1945...	52.80	52.70	52.00	51.90	52.10	52.50	55.00	52.50	51.40	51.00	51.30	51.40	52.20
1946...	50.90	50.30	47.50	48.00	49.60	51.50	60.00	59.10	57.80	66.00	89.90	91.50	60.20
1947...	90.40	88.20	88.00	88.00	83.70	79.60	79.00	75.50	75.60	90.60	89.10	94.80	85.20
1948...	95.10	88.60	87.90	89.40	90.70	92.20	96.00	76.60	68.10	63.70	69.00	68.80	82.20
Av.	36.90	37.00	37.10	37.75	37.80	37.10	36.95	34.95	34.65	36.30	38.00	38.15	36.90

Source: Compiled as follows:

September 1910—June 1927 from *Yearbook of Agriculture, 1931*, p. 686.
July 1927—June 1937 from *Agricultural Statistics, 1938*, p. 115.
July 1937—June 1942 from *Agricultural Statistics, 1942*, p. 169.
July 1942—December 1942 from *Crops and Markets*, April 1943. (U.S.D.A.)
January 1943—December 1948 from *Agricultural Prices* (each month).

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